



Digitized by the Internet Archive
in 2025

https://archive.org/details/bwb_KV-648-615_48

VOLUME XLVIII

July-Dec. 1925

THE NATIONAL GEOGRAPHIC MAGAZINE

INDEX

July to December, 1925

VOLUME XLVIII

PUBLISHED BY THE
NATIONAL GEOGRAPHIC SOCIETY
HUBBARD MEMORIAL HALL
WASHINGTON, D.C.

\$3.50 A YEAR

COPYRIGHT, 1925

NATIONAL GEOGRAPHIC SOCIETY

GEOGRAPHIC ADMINISTRATION BUILDINGS
SIXTEENTH AND M STREETS NORTHWEST, WASHINGTON, D. C.

GILBERT GROSVENOR, President	HENRY WHITE, Vice-President
JOHN OLIVER LA GORCE, Vice-President	O. P. AUSTIN, Secretary
JOHN JOY EDSON, Treasurer	GEO. W. HUTCHISON, Associate Secretary
BOYD TAYLOR, Assistant Treasurer	EDWIN P. GROSVENOR, General Counsel
FREDERICK V. COVILLE, Chairman	Committee on Research

EXECUTIVE STAFF OF THE NATIONAL GEOGRAPHIC MAGAZINE

GILBERT GROSVENOR, EDITOR

JOHN OLIVER LA GORCE, Associate Editor
WILLIAM J. SHOWALTER, Assistant Editor
RALPH A. GRAVES, Assistant Editor
FRANKLIN L. FISHER, Chief of Illustrations Division
J. R. HILDEBRAND, Chief of School Service

BOARD OF TRUSTEES

CHARLES J. BELL President American Security and Trust Company	WILLIAM HOWARD TAFT Chief Justice of the United States	CHARLES G. DAWES Vice-President of the United States
JOHN JOY EDSON Chairman of the Board, Washington Loan & Trust Company	GRANT SQUIRES Military Intelligence Division, General Staff, New York	JOHN BARTON PAYNE Chairman American Red Cross
DAVID FAIRCHILD In charge of Agricultural Explorations, U. S. Department of Agriculture	C. M. CHESTER Rear Admiral U. S. Navy, Formerly Supt. U. S. Naval Observatory	A. W. GREELY Arctic Explorer, Major General U. S. Army
C. HART MERRIAM Member National Academy of Sciences	J. HOWARD GORE Prof. Emeritus Mathematics, The George Washington University	GILBERT GROSVENOR Editor of National Geographic Magazine
O. P. AUSTIN Statistician	FREDERICK V. COVILLE Botanist, U. S. Department of Agriculture	GEORGE OTIS SMITH Director U. S. Geological Survey
GEORGE R. PUTNAM Commissioner U. S. Bureau of Lighthouses	RUDOLPH KAUFFMANN Managing Editor The Evening Star	O. H. TITTMANN Formerly Superintendent U. S. Coast and Geodetic Survey
GEORGE SHIRAS, 3d Formerly Member U. S. Congress, Faunal Naturalist, and Wild-game Photographer	JOHN FOOTE, M. D. Professor of Pediatrics, Georgetown University	HENRY WHITE Member American Peace Commission, Formerly U. S. Ambassador to France, Italy, etc.
E. LESTER JONES Director U. S. Coast and Geodetic Survey	JOHN OLIVER LA GORCE Associate Editor National Geographic Magazine	STEPHEN T. MATHER Director National Park Service

ORGANIZED FOR "THE INCREASE AND DIFFUSION OF GEOGRAPHIC KNOWLEDGE"

TO carry out the purposes for which it was founded thirty-seven years ago, the National Geographic Society publishes this Magazine. All receipts are invested in the Magazine itself or expended directly to promote geographic knowledge.

ARTICLES and photographs are desired. For material which the Magazine can use, generous remuneration is made. Contributions should be accompanied by an addressed return envelope and postage.

IMMEDIATELY after the terrific eruption of the world's largest crater, Mt. Katmai, in Alaska, a National Geographic Society expedition was sent to make observations of this remarkable phenomenon. Four expeditions have followed and the extraordinary scientific data resulting given to the world. In this vicinity an eighth wonder of the world was discovered and explored—"The Valley of Ten Thousand Smokes," a vast area of steaming, spouting fissures. As a result of The Society's discoveries this area has been created a National Monument by proclamation of the President of the United States.

AT an expense of over \$50,000 The Society sent a notable series of expeditions into Peru to investigate the traces of the Inca race. Their

discoveries form a large share of our knowledge of a civilization waning when Pizarro first set foot in Peru.

THE Society also had the honor of subscribing a substantial sum to the expedition of Admiral Peary, who discovered the North Pole.

NOT long ago The Society granted \$25,000, and in addition \$75,000 was given by individual members to the Government when the congressional appropriation for the purpose was insufficient, and the finest of the giant sequoia trees of California were thereby saved for the American people.

THE Society is conducting extensive explorations and excavations in northwestern New Mexico, which was one of the most densely populated areas in North America before Columbus came, a region where prehistoric peoples lived in vast communal dwellings and whose customs, ceremonies, and name have been engulfed in an oblivion.

THE Society also is maintaining expeditions in the unknown area adjacent to the San Juan River in southeastern Utah, and in Yunnan, Kweichow, and Kansu, China—all regions virgin to scientific study.

CONTENTS

	PAGE
Bats of the Carlsbad Cavern. By VERNON BAILEY.....	321
Bird Life Among Lava Rock and Coral Sand: The Chronicle of a Scientific Expedition to Little-known Islands of Hawaii. By ALEXANDER WETMORE.....	77
Canyons and Cacti of the American Southwest. Color insert. XVI plates.....	274
Cattle of the World, The. Color insert. XX plates.....	638
Collarin' Cape Cod: Experiences on Board a U. S. Navy Destroyer in a Wild Winter Storm. By LIEUTENANT H. R. THURBER, U. S. Navy.....	427
Everyday Life in Pueblo Bonito: As Disclosed by the National Geographic Society's Archeologic Explorations in the Chaco Canyon National Monument, New Mexico. By NEIL M. JUDD.....	227
Experiences of a Lone Geographer: An American Agricultural Explorer Makes His Way Through Brigand-infested Central China en Route to the Amne Machin Range, Tibet. By JOSEPH F. ROCK.....	331
Exploring in the Canyon of Death: Remains of a People Who Dwelt in Our Southwest at Least 4,000 Years Ago Are Revealed. By EARL H. MORRIS.....	263
Flying Over the Arctic. By LIEUTENANT COMMANDER RICHARD E. BYRD, U. S. Navy (Ret.)	519
From England to India by Automobile: An 8,527-mile Trip Through Ten Countries, from London to Quetta, Requires Five and a Half Months. By MAJOR F. A. C. FORBES-LEITH	191
History's Greatest Trek: Tragedy Stalks Through the Near East as Greece and Turkey Exchange Two Million of Their People. By MELVILLE CHATER.....	533
Iridescent Isles of the South Seas. Color insert. XVI plates.....	402
MacMillan Arctic Expedition Returns, The: U. S. Navy Planes Make First Series of Overland Flights in the Arctic and National Geographic Society Staff Obtains Valuable Data and Specimens for Scientific Study. By DONALD B. MACMILLAN.....	477
MacMillan Arctic Expedition Sails, The.....	225
MacMillan in the Field.....	473
New Discoveries in Carlsbad Cavern: Vast Subterranean Chambers with Spectacular Decorations Are Explored, Surveyed, and Photographed. By WILLIS T. LEE.....	301
Pages from the Floral Life of America. Color insert. XXIV plates.....	44
Rediscovering the Rhine: A Trip by Barge from the Sea to the Headwaters of Europe's Storied Stream. By MELVILLE CHATER.....	1
Romance of Science in Polynesia, The: An Account of Five Years of Cruising Among the South Sea Islands. By ROBERT CUSHMAN MURPHY.....	355
Scientific Aspects of the MacMillan Arctic Expedition.....	349
Sun-painted Scenes in the Near East. Color insert. XVI plates.....	540
Taurine World, The: Cattle and Their Place in the Human Scheme—Wild Types and Modern Breeds in Many Lands. By ALVIN HOWARD SANDERS, D. Agr., LL. D.....	591
Toilers of the Sky: Tenuous Clouds Perform the Mighty Task of Shaping the Earth and Sustaining Terrestrial Life. By MCFALL KERBEY.....	163
Tripolitania, Where Rome Resumes Sway: The Ancient Trans-Mediterranean Empire, on the Fringe of the Libyan Desert, Becomes a Promising Modern Italian Colony. By COLONEL GORDON CASSERLY.....	131
Under Italian Libya's Burning Sun. Color insert. VIII plates.....	140
Waimangu and the Hot-spring Country of New Zealand: The World's Greatest Geyser Is One of Many Natural Wonders in a Land of Inferno and Vernal Paradise. By JOSEPH C. GREW.....	109

PRESS OF JUDD & DETWEILER, INC.
WASHINGTON, D. C.

1925

INDEX FOR VOL. XLVIII (JULY-DECEMBER), 1925

AN ALPHABETICALLY ARRANGED INDEX. ENTRIES IN CAPITALS REFER TO ARTICLES AND INSERTS

July, pp. 1-108
August, pp. 109-226
September, pp. 227-354

October, pp. 355-476
November, pp. 477-590
December, pp. 591-710

A	Page
Aba (cloak without a seam): Near East.....ill.	217
(color insert) Plate IX, 540-557	
Abalone shell, Ornaments of.....273, 274, 292	
Aberdeen-Angus (Cattle).....591, 617, 704-707, ill.	687
Aberdeen-Angus (Cattle).....(color insert)	
Plate XIX, 638-679	
Acanthus Family (Hairy Ruellia).....44	
(color insert) Plate I, 46-71	
Acropolis (Athens), Reference to the.....563	
Adana, Turkey.....211	
Adrianople, Turkey.....204-205, 557, ill.	209
Aduan Bey of the Kemalist Government.....205	
Ægean Islands, Reference to.....540	
Ægean Sea, References to the.....533, 563	
Aerial gas attack: U. S. Navy maneuvers.....467	
Aeronautics, Clouds and.....180	
Aesculapius, Statue of: Tripolitania.....ill.	161
Afghan invasion: Persia.....222	
Africa, Clouds and vegetation in.....179, 180	
Africa: Hailstones as large as tennis balls.....ill.	178
Africa, North: Italian Libya—map.....138	
Africa, North: Tripolitania, Where Rome Re-	
sumes Sway. By Col. Gordon Casserly.....131	
Africa, North: Under Italian Libya's Burning Sun	
(color insert) VIII plates, 140-149	
Africa, Southwest, arid region of.....180	
Africander Bull, Red.....(color insert)	
Plate XVII, 638-679	
Agades, French West Africa.....151	
Agal (coil of wool or camel hair), Arab wearing	
an.....ill.	217
Agassiz, (Prof.) Alexander, References to.....365, 369	
Agram (Zagreb), Croatia.....198, 201	
Agricultural Explorer: Experiences of a Lone	
Geographer in Brigand-infested Central China.	
By Joseph F. Rock.....331	
Agricultural scenes: Germany.....ill. 7, 13, 18, 19, 22-25	
Agriculture in Tibet (working with Zos).....ill.	610
Agrippa, Marcus Vipsanius, Reference to.....9	
Ahurei Bay, Rapa Island.....(text) 381, 425, 426	
(color insert) Plate IV, 402-419	
Ahurei, Rapa Island.....(text) 381, 419, 425	
(color insert) Plate IV, 402-419	
Air, Clouds and.....168, 170, 171, 174, 177, 180, 189	
Air temperatures, Charting upper: Arctic Re-	
gions.....351-352	
"Airing the bunting": U. S. Navy destroyer.....ill.	466
Airplane travel and clouds.....189	
Airplanes, Amphibian: MacMillan Arctic Expedi-	
tion.....225, 226, 475, 478, 479, 495, 502, 505, 507	
509, 510, 511, 519, 520, 521-522, 524, 527-529, 531	
532, ill. 225, 521-526, 528, 530	
Airplanes, Destroyers and.....ill. 439, 447, 457 470	
Airplanes, Manifesto-dropping: Near East.....539-540	
Aivali, Asia Minor.....572, 574	
Ak-kom-a-ding-wa (Eskimo): Greenland.....ill.	490
Alaska, Golden Plovers (birds) from.....393	
Alaska, Rainclouds and.....179	
Alaska, References to.....352, 353, 477, 490, 509	
Albatrosses (birds): Hawaiian Islands.....78, 86, 103, 108	
ill. 80, 82, 90, 91, 96, 102, 105	
Aleppo, Syria.....211, 214	
Aleutian Islands, References to the.....179, 352	
Alexander the Great, References to.....209, 211, 222, 533	
Alexandra Fiord, Ellesmere Island.....505	
Alexandretta, Syria.....191, 211	
Alga, Turtles feed on.....(text) 97, 104	
Algiers, Algeria.....131	
Alida Lake, Greenland.....ill.	488
Alkali flat, Land of: New Mexico.....317	

	Page
Alpine scenery: Greenland.....ill.	512
Alpini in Africa (1913).....159	
Alps Mountains, References to the.....41, 42, 43	
Alsace-Lorraine, References to.....34, 35, 39	
Altamira, Cave of (Spain): Prehistoric draw-	
ings.....ill.	682
Alto-cumulus clouds.....180, ill. 184, 185	
Alto-stratus clouds.....ill. 172, 184	
Alum, Terraces of: New Zealand.....115	
Alwiyeh Club (British): Bagdad.....219	
Amara, Iraq (Mesopotamia).....(text) 215	
Amaryliss Family (Western Spiderlily).....44	
(color insert) Plate I, 46-71	
Amazon, World's greatest river.....179	
Amenherkhepshef, Prince of Egypt.....(text) 621	
America, Floral Life of.....44	
American college: Smyrna.....534	
American consul general: Smyrna.....534	
American Disaster Relief Committee: Smyrna	
534, 539-540, ill.	564
American Guernsey Cattle Club, Triplets regis-	
tered by the.....ill.	689
American Lantana, Tropical (plant).....371	
American Lotus (<i>Nelumbo lutea</i> (Willd.) Pers.)	
(color insert) Plate XXIV, 46-71	
American Museum of Natural History.....264, 360	
ill. 377, 384	
American Quarantine Station: Makronisi Island..	
ill.	563
576	
American Radio Relay League: MacMillan Arctic	
Expedition.....475-476, 482, 491	
American relief: Near East.....534, 539-540, 563	
ill. 558-560, 576, 578	
American sailors aid in relief work: Near East..	
ill. 558, 559, 560	
American Samoa: Fishing canoe.....ill.	391
American Wild Flowers.....(color insert)	
XXIV plates, 46-71	
Amne Machin Range, Tibet, Experiences of a	
Lone Geographer Through Brigand-infested	
China to the. By Joseph F. Rock.....331	
Amphibian airplanes: MacMillan Arctic Expedi-	
tion.....225, 226, 475, 478, 479	
495, 502, 505, 507, 509, 510, 511, 519, 520, 521-522	
524, 527-529, 531, 532, ill. 225, 521-526, 528, 530	
Amphibians, Polynesia.....373	
Amsterdam, Holland.....34	
Anaa Island, Tuamotu Archipelago.....419	
Anatoli Hissar, Towers of: Sweet Waters of Asia	
(color insert) Plate III, 540-557	
Anatolia (Asia Minor).....205, 206	
209-210, 211, ill. 210	
Ancient civilization exalted the herd.....608, 610	
Andermatt, Switzerland.....42, 43, ill. (aerial view) 43	
Andes Mountains, Clouds and the.....179	
Anethesia's Faith of Hill Stead (cow).....ill.	685
Angora, Turkey.....204, 205, 590, ill.	536
Animal life: New Mexico.....319	
Ankurgomba, Iamasery, China.....343	
Anoritok, Greenland.....502	
Antibes, France, Reference to.....193	
Antioch, Lake of: Asia Minor.....211	
Antwerp, Belgium.....1, 2, 3, 36	
Apartment house, Pueblo Bonito, N. Mex.....ill.	231
Apartment house: Pueblo Bonito, New Mexico,	
Everyday Life in. By Neil M. Judd.....227	
Apataki Island: Copra workers.....ill.	357
Apollo, Statue of: Tripolitania.....ill.	161
Apostles fished, Where the: Lake of Antioch.....	
211	
Apple butter, Grape syrup used like: Near East	
(text) Plate XI, 540-557	

	Page		Page
Apple Family (Downy Hawthorn).....	45	Australian-bred Shorthorn Melba (dairy cow).....	ill. 685
(color insert) Plate III, 46-71		Austro-Hungarian Empire, Naval base of the	
Aprons, Indian women wearing.....ill. 242, 244, 248-251		former: Trieste.....(text) 200	
Arab Kingdom, Iraq: Scenes.....ill. 190, 215		Automobile, An ox pulling a mired: Chosen.....ill. 694	
Arab population: Tripolitania.....151		Automobile assembling plant, American: Trieste.....	200
Arab soldiers: Tripolitania.....131-132, ill. 137			197, 200
Arab woman, Town-bred: Tripoli.....(color insert)		Automobile Association, Bulgarian.....	204
Plate VIII, 140-149		Automobile expedition, Italian: Tripolitania.....149, 151	
Arabian emir, An: Damascus.....(color insert)		Automobile factory, Ford: Trieste.....197, 200	
Plate XV, 540-557		Automobile, From England to India by. By Maj.	
Arabic inscription: Turkey.....(text) Plate IV, 540-557		F. A. C. Forbes-Leith.....	191
Arabs, Desert: Bagdad.....ill. 217		Automobile route, England to India: Map.....	193
Arcaded courts, Quaint: Tripolitania.....131, ill. 132		Automobiles, National Geographic Society's:	
Arch of Marcus Aurelius: Tripoli.....149, ill. 135		Pueblo Bonito, N. Mex.....ill. 229	
Archæology: Pueblo Bonito (New Mexico).....227		Avanyu's Retreat, Carlsbad Cavern, N. Mex.....	308, 309
ill. 228, 230, 231			473, 475
Arched street: Tripoli.....132, 135, ill. 139		Aviation, Arctic.....	519
Architecture, Byzantine: Bulgaria.....ill.		Aviation, Flying Over the Arctic. By Lieut.	
(aerial view) 208		Commander Richard E. Byrd.....	519
Architecture, Rainbow as a pattern for.....189		Aviation, Lessons in: Bird Reservation, Hawaiian	
Architecture, Sananiani, Example of.....220		Islands.....ill. 90, 91, 96, 102	
Arctic animals, Color usual to.....606		Aviators, Bird: Laysan Albatrosses.....ill. 90, 91, 96, 102	
Arctic Expedition, MacMillan.....473		Axel Heiberg Island.....475, 477, 509, 527	
Arctic Expedition, MacMillan. By Donald B.		Ayrshire (Cattle).....617, 636, 699-701, 703-704	
MacMillan.....477		ill. 688, 692	
Arctic Expedition, MacMillan: Scientific Aspects. 349		Ayrshire Cows.....(color insert) Plate XVIII, 638-679	
Arctic Expedition Sails, MacMillan.....225		Azalea, Flame (<i>Azalea lutea</i> L.).....72	
Arctic falcons, Carrier pigeons killed by.....520		(color insert) Plate XV, 46-71	
Arctic, Flying Over the. By Lieut. Commander			
Richard E. Byrd.....519			
Arctic Regions: Map. Supplement, November, 1925			
Area, Greece and Arkansas have about the same			
Area: Turkey.....567, 584			
Argentina, Cattle industry in.....591, 597, 598, ill. 600			
Argentine National (Cattle) Show, 1925: Prize			
bull.....684			
Aristotle, Reference to.....610			
Arizona, Cañon del Muerto: Exploring in the			
Canyon of Death. By Earl H. Morris.....263			
Arizona, Eastern: Map.....(sketch) 232			
Arizona: Scenes.....ill. 264-272, 292-299			
(color insert) Plates I, II, VI-VIII, 274-291			
Armenian church used as a stable: Adrianople.....205			
Armenian quarter, Smyrna.....533, 535			
Armenians in Turkey.....205			
Armet, Shell: Arizona.....291, ill. 298			
Armory, Carlsbad Cavern, N. Mex.....ill. 305			
Arrowleaf Tear-thumb (<i>Tracaulon sagittatum</i> (L.)			
<i>Small</i>).....46, (color insert) Plate VII, 46-71			
Art, Cattle in.....ill. 621, 626, 682, 696, 699			
ill. 621, 626, 682, 696, 699			
Art, Eskimo: Greenland.....ill. 497			
Art, Indian: New Mexico.....227, 239-240			
ill. 237, 239, 242-244, 247, 248			
Art, Metal-work: Damascus.....ill. 214			
Art, Prehistoric Indian: Arizona.....ill. 292, 298, 300			
Artesian well: Tripolitania.....151			
Arts and crafts, Training in: Near East refugees			
564, 584, ill. 585			
Atlantic seaboard, Coming of cattle to the.....633-635			
Arum Family (plants).....44, 45, (color insert)			
Plates I, IV, 46-71			
Aryan stock, Persians are of the pure.....220			
Asia Minor (Anatolia).....205, 206, 209-210, 211, ill. 210			
Asia Minor: History's Greatest Trek—Greece and			
Turkey Exchange Two Million of Their People.			
By Melville Chater.....533			
Asian Olympus (Keshish Dag): Turkey.....(color			
insert) Plate V, 540-557			
Asleep in a barrel, Woman: Fiume.....ill. 202			
Ass, pacemaker for the camel: Near East.....(color			
insert) Plate XIII, 540-557			
Aster Family (plants).....44-45, (color insert)			
Plates II, III, 46-71			
Astronomical calendar, Gutenberg's.....20			
Athens, Greece.....539, 540, 559, 563, 564			
566, 570, 590, ill. 569-574			
Atlas, International Cloud.....(text) 182			
Atmosphere, Clouds and the.....167, 168			
Atolls (coral rings): Pacific Ocean.....104, 106, 107, 363			
365-366, 369, 386, ill. 369			
Attar of roses, Land of the: Bulgaria.....201			
Auckland, New Zealand.....ill. 121, 124			
Aurelius, Marcus, Arch of: Tripoli.....ill. 135			
Aurochs, Teutons knew the Celtic Shorthorn as			
the.....604			
Austin, Tex.: State Capitol.....ill. 174			
Austral Islands: Map.....366			
Austral Islands: Pacific Ocean.....360, 361, 385, 388			
419, ill. 367, 369, 371, 387			
Austral Islands: Scenes.....(color insert)			
Plates I, VIII, IX, XIV, 402-419			
Australia, Cattle industry in.....597, ill. 599			

B

Babies, Zufi Indian.....ill. 249	
"Baby Beef," Day of.....632, ill. 687	
Baby, Mother and: Arctic Regions.....ill. 501	
Baby, Slavic Mother and.....ill. 204	
Babylon, Ruins of.....220	
"Babytown-on-the-Rhine," Strasbourg is.....35	
Bacharach, Germany.....17	
Bache Peninsula, Ellesmere Island.....503, 507, 524	
Backgammon games, Reference to.....574	
Badger State (Wisconsin), Reference to the.....609	
Baffin Bay, Arctic Regions.....(text) 481	
Bagdad, Iraq (Mesopotamia).....191, 211, 214, 215	
217-220, ill. 216	
Bailey, Vernon.....ill. (distant view) 320	
Bailey, Vernon: Bats of Carlsbad Cavern, New	
Mexico.....321	
Baker, Negro: Tripolitania.....137, ill. 150	
Bakewell, Robert, of Dishley.....614, 620, 621	
Bali, Island of: Sacred cows.....ill. 697	
Balkan Wars, Greece and the.....561	
Balkans, Stormy petrels of the: <i>Comitadj</i>557	
Ballantyne, (Robert M.), Reference to.....357	
Balloon throats, Birds with toy: Pacific Islands	
(text) 397, 402	
Balloons, Hydrogen causes rise of.....167, 168	
Baltic Sea, Reference to the.....9	
Baluchistan Camel Corps Patrol.....(text) 221	
Bamberg, Germany.....21	
Bamboo, Irrigation wheel of: China.....ill. 339	
Banana plant cultivation: Tahiti.....363	
Bananas: Pacific Islands.....(color insert)	
Plates VIII, XIV, 402-419	
Bananas, Wild (fei): Pacific Islands.....370, 394, 396	
ill. 385	
Band, Arab soldier: Tripolitania.....132	
Bank notes printed in yellow (signifying wealth	
in butter).....(text) 607	
Banks, (Sir) Joseph, References to.....358, 363	
Banner, Tribal: Iraq (Mesopotamia).....ill. 190	
Banteng (<i>Bos (Bibos) sondaicus</i>).....604, 640	
Banteng (<i>Bos sondaicus</i>): Malay Peninsula.....	
(color insert) Plate II, 638-679	
Barbed-wire fencing, Cattle and.....629	
Barber, Outdoor: Persia.....ill. 219	
Barber shop, Outdoor: Turkey.....ill. 584	
Barge, Steam (<i>Rijn-Schelde</i>): Rhine River.....1, 2, 3	
6, 9, 14, 21, 26, 36, ill. 2, 3	
Barge Trip from the Sea to the Headwaters of	
the Rhine. By Melville Chater.....1	
Barges, Rhine River.....1, 2, 3, 6, 9, 11, 14, 21, 26	
34, 36, 37, ill. 2, 3, 15, 33	
Bark cloth: Pacific Islands.....(text) 386	
Barns, Dairy: U. S. Soldiers' Home, Washing-	
ton, D. C.....ill. 628, 631	
Barracks, Refugee: Near East.....559, 561, ill. 587	
Barrel, Woman asleep in a: Italy.....ill. 202	
Barrels, Oil: <i>Rijn-Schelde</i> (Rhine River barge).....1, 3	
Barrels, Vender of: Fiume.....ill. 202	
<i>Barricano</i> (white woolen shroud): Africa.....131, 140	
Bartlett, (Capt. Robert), Reference to.....524	
Bas-Rhin, Department of (Alsace).....35	
Basel, Switzerland.....(text) 2, 36, 37, 39, ill. 36, 37	

	Page		Page
Basket, Gigantic reed (circular boat): Bagdad.....	216	Billy-the-Kid, Reference to.....	317
Basket Makers, Indians called.....(text) 292, 296, 300	292, 296, 300	Bingen, Germany.....	10, 17, 19, 23, 26, 27, 36
Baskets, Indian: U. S. Southwest.....	238, 240, 270, 292		ill. 24, 25
293, 297, 300, ill. 242, 244, 253, 294, 295, 297, 299	293, 297, 300, ill. 242, 244, 253, 294, 295, 297, 299	Bir el-Gheddahia, Tripolitania.....	149
Basra, Iraq (Mesopotamia).....	219	Bir el-Hasciadia, Tripolitania.....	149
Bass Rocks, Pacific Ocean.....	367	Bird aviators: Laysan Albatrosses.....	90, 91, 96, 102
Bath, Public (Roman ruins): Tripolitania.....	161	Bird dance, Weird: Laysan Island.....	105
	ill. 161	Bird in the hand, A.....	84
Bats carry their young in flight.....	322-323, 330	BIRD LIFE AMONG LAVA ROCK AND CORAL SAND: THE CHRONICLE OF A SCIENTIFIC EXPEDITION TO LITTLE-KNOWN ISLANDS OF HAWAII. BY ALEXANDER WETMORE.....	77
Bats, Catching: Carlsbad Cavern, N. Mex.....	320	Bird specimens: MacMillan Arctic Expedition.....	514
BATS OF THE CARLSBAD CAVERN (NEW MEXICO). BY VERNON BAILEY.....	321		ill. 489
Battle Harbor, Labrador.....	225, 486, 514, 516, 517	Bird specimens, Preservation of.....	351
Battle Island, Labrador.....	ill. 350, 473, 474, 476, 478	Birds: Arctic Regions.....	225
Battle of Zama, B. C. 202.....	ill. 478, 480	Bird's-eye view, A: Laysan Albatross in flight.....	ill. 96
Bavarian state forests (Germany).....	21	Birds, <i>Bowdoin</i> (ship) visited by.....	518
Bay, Ahurei: Rapa Island.....(text) 381, 425, 426	381, 425, 426	Birds: South Sea Islands.....	359, 360, 373, 383
	(color insert) Plate IV, 402-419	389, 393, 394, 396, 402, ill. 364, 394-398, 400, 401	389, 393, 394, 396, 402, ill. 364, 394-398, 400, 401
Bay, Baffin: Arctic Regions.....	481	Birds, Tree full of nesting: Laysan Island.....	ill. 100
Bay, Buchanan: Ellesmere Island.....	503, 505	Birds, Tropical: South Sea Islands.....(color insert)	Plates X-XIII, 402-419
Bay, Buzzards, Mass.....(text) 392	392	Birthplace, Beethoven's: Bonn, Germany.....	9
Bay, Disko: Greenland.....(text) 484	484	Birthplaces of clouds.....	163, 170, ill. 162
Bay Fiord, Ellesmere Island.....	475, 505, 527	Bishop Museum, Honolulu.....(text) 77, 78, 384	77, 78, 384
Bay, Hathue: Nukuhiva Island.....	ill. 379	Bison, American.....	623, 624
Bay, Ingfield: Greenland.....	510, 511, 513	Bison and Buffalo.....	603, 604
Bay, McCormick: Greenland.....	511	Bison, Prehistoric drawings of: Spain.....	ill. 682
Bay, Melville: Greenland.....	482, 500, ill. 486, 506	Bisontine and Taurine (cattle) groups.....	604
Bay, North Star: Greenland.....	500	Black-footed Albatrosses: Hawaiian Islands.....	ill. 80, 82
Bay of Plenty, New Zealand.....(text) 120	120	Black Forest region, Germany.....	37, 39, ill. 34, 35
Bay, Robertson: Greenland.....(text) 497, 502	497, 502	Black Jack, Reference to.....	317
	510, 511, 530	Black Polled (or Hornless) Cattle.....(color insert)	Plate XIX, 638-679
Bay, Sawyer: Ellesmere Island.....	507	Bladderwort Family (Zigzag Bladderwort).....	46
Bay, Taiohae: Nukuhiva Island.....(color insert)	Plate III, 402-419		(color insert) Plate IX, 46-71
Bayezid I, Castle built by: Sweet Waters of Asia	(color insert) Plate III, 540-557	Blades, Prehistoric oaken: Arizona.....	ill. 294
		Blake, (Adm.) Robert: British Navy.....	149
Beach beauties: Tripoli.....	ill. 155	Blanket, Indian girl weaving a: New Mexico.....	ill. 251
Beach magnolia (<i>Scaevola lobelia</i>): Shrub.....	108	Bligh, (William), References to.....	358, 388, 392
Bead collars, Girls wearing: Greenland.....	ill. 483, 510, 514	Blue-faced Boobies (birds): Hawaiian Islands.....	ill. 80, 99
Bear hunting: Arctic Regions.....	500	Blue Goose, Life history of the.....	350
Beasts of burden, Water Buffalo as.....	603	Bluets (<i>Houstonia caerulea</i> L.).....	72-73
Beauty, Polynesian women have great.....	377, 380		(color insert) Plate XVII, 46-71
Beck, Rollo H.: Whitney South Sea Expedition	384, 385, 386, 388, 393, 394, 398, 419	Boat, Circular (gufah): Bagdad.....	ill. 216
Bedouin tribes: Syrian Desert.....	211, 214, 215	Boat scene: China.....	ill. 338
Beechdrops (<i>Leptanthium virginianum</i> (L.) Raf.)	45	Boat, Women's: Greenland.....	ill. 514
	(color insert) Plate V, 46-71	Boatmen, Peerless: Rapa Island.....(text) 383, 425-426	383, 425-426
Beef, Cuts of.....	ill. 597	Boats, Cattle: Peru.....	ill. 701
Beef, England's love of, brought about new types	617, 620-621	Boats, Chinese river.....	ill. 338, 340
Beef export: United States.....	598, 600	Boats, Fishing: Constantinople.....(color insert)	Plate II, 540-557
Beef extract, Manufacture of.....	628	Boats, Hunting (kayaks): Arctic Regions.....	ill. 487
Beef, Good, for everybody.....	603		511, 512
Beer, Barge skippers drink a sweetish: Rhine River	21	Boats, Refugee: Near East.....	539, 540, 557, 576, 590
Beethoven, (Ludwig van), Reference to.....	9	ill. 538, 558, 560, 561, 563, 566, 568	538, 558, 560, 561, 563, 566, 568
Beggar-ticks (<i>Bidens frondosa</i> L.).....	45	Body fishers: Smyrna.....	539, ill. 565
	(color insert) Plate III, 46-71	Bokhara, Turkoman from.....	211
Behidj Bey, Ennis: Turkish Foreign Office.....	205	Bolabola Island, Society Group.....	ill. 369
Beilan Pass, Syria.....	211	Bone meal, Fertilizer made from.....	591, 592
Beitstad Fiord, Ellesmere Island.....	505	Bonheur, Rosa, "Plowing in the Nivernais" (painting) by.....	ill. 696
Belgian Breeds (Cattle).....	665	Bonitians, Prehistoric: New Mexico.....	231, 233, 245
Belgrade, Yugoslavia.....	191, 201, ill. 207	Bonn, Germany.....	9, 15
Bell, Song of the (cowbells).....	603	Boobies (birds): Pacific Islands.....	78, 81, 82, 83
Belle, Maori: New Zealand.....	ill. 130	103, 402, 426, ill. 80, 92, 99, 100, 107, 398, 401	103, 402, 426, ill. 80, 92, 99, 100, 107, 398, 401
Belleisle Strait, Labrador.....	516	"Boom Town" of Anatolia, Angora.....	ill. 536
Bells, Sacred cows with enormous: Island of Bali	ill. 697	Boos, (Sir), of Waldeck.....	19
Belted Galloway bull.....	ill. 692	Boot, Hip, filled with wine: German legend.....	19
Beni, Tripolitania.....	149	Boots, Red-topped: Turkey.....(color insert)	Plate VII, 540-557
Bennett, F. D., References to.....	358, 373	Boots, Sealskin: Arctic Regions.....	ill. 483, 491, 499, 501, 502, 508-510
Bennett, (Pilot): MacMillan Arctic Expedition	503, 505, 510, 511, 521, 522, 531, 532	Borage Family (Vipers-bugloss).....	45
Berbers from Murzuk.....	(color insert) Plate II, 140-149		(color insert) Plate V, 46-71
Bethlehem (Palestine), Women from.....(color insert) Plates XIV, XV, 540-557	393, 424	Boris III, King of Bulgaria.....	201-202, ill. 208
Beverage: Coconut milk.....	393, 424	Borresen, Doctor: Godthaab, Greenland.....	515
Beyrland Island: Holland.....	3	<i>Bos taurus</i> (cattle), Original.....(text) 604	604
Bible, Gutenberg's, Reference to.....	21	Bosporus Strait.....	209, (color insert) Plate II, 540-557
Biblical days, Cattle in.....	612	"Bossy" gets her name, Where.....	603
Bibovines, East Indian humped.....	604	Boston Light Vessel.....	431, 433, 436, 464
Bicycles, Negroes riding: Tripolitania.....	140	Boston (Mass.), Market place in.....	634
Big Room, Carlsbad Cavern, N. Mex.....	311, 312	Boston (Mass.), U. S. Navy yard at.....	427, 433, ill. 428
	313, 316, ill. 303, 311, 312	Boston State House, Original market place.....	634
Bighorn Cave, N. Mex.....	329, 330	"Bosun's chairs," Sailors painting a smokestack	ill. 450
"Billing Doves" (rock formation): Carlsbad Cavern, N. Mex.....	ill. 315	Boundary difficulties, Tripolitania-Tunisia.....	ill. 158
Bills, saw-edged, Birds with.....	82	Bounty mutiny of 1790: Pitcairn Island.....	388, 392

	Page
Bowdoin (ship): MacMillan Arctic Expedition..	349
350, 351, 482, 486, 487, 495, 497, 498, 499, 500	
502, 507, 510, 511, 513, 514, 516, 517, 518, 519, 522	
ill. 224, 474, 476, 478, 479, 481, 485-487, 497, 504	
509, 512, 517, 536	
Bowls, Stone: Hawaiian Islands.....	77, 79
Boy and cow: "When a Feller Has a Friend".....	607
Boy, Turkish: Yugoslavia.....	ill. 205
Boys' and Girls' (Cattle) Club: Exhibit.....	ill. 687
Boys of Haslach, Black Forest region.....	ill. 35
Boys, Pacific Island.....	ill. 357, 387, 399
Bozeman, Mont., Cattle near.....	ill. 594
Brahman breed (cattle).....	604, ill. 691, 704
Brahmans (Zebus) (<i>Bos indicus</i>): India.....(text)	
640-641, (color insert) Plate IV, 638-679	
Branding cattle: U. S. West.....	ill. 681
Brazil, Oxen in.....	ill. 691
Brazil, Rainfall in.....	179
Bread making, Indian: U. S. Southwest.....	ill. 242, 250
Bread making: Tripolitania.....	ill. 137, ill. 150
Bread, Refugee relief: Near East.....	ill. 578, 580
Breadfruit, food staple: Pacific Islands.....	355, 370
Breeder's art, Achievements of the (cattle).....	617, 620, 621, 623, 629-630
Brewster, Governor: Maine.....	518
Briare, France, An old inn at.....	193, ill. 194
Bricks, Clay, Refugees make: Near East.....	ill. 583
Bride, Chase for a Maori: New Zealand.....	130
Bridge of a destroyer.....	ill. 430, 433, 441
Bridge-of-Boats, Coblenz, Germany.....	14
Bridge, Rainbow Natural: Utah.....(color insert)	
Plate III, 274-291	
Bridges, Rhine River.....	ill. 14, ill. 8, 14, 24, 30
Brigand-infested Central China, Experiences of a	
Lone Geographer Through. By Joseph F. Rock	331
Brigandage: U. S. Southwest.....	243, 245
Brigham, (William T.), References to.....	360, 371
Briquette industry: Germany.....	10
Bristle-thighed Curlews (birds): Laysan Island.....	ill. 104
British Army in Bagdad.....	217, 218-219
British Navy: Near East.....	540, ill. 558, 560
British New Guinea: Cattle.....	ill. 695
British sailors aid in relief work: Near East.....	ill. 558, 560
Brittany (Cattle).....	656-657
Broom-rape Family (Beechdrops).....	45
(color insert) Plate V, 46-71	
Bromfield, Abram: Labrador.....(text)	482, 495
497, 498, 516	
Bromfield, Sam, broadcasting from Labrador.....	ill. 482
Brown Swiss Cow.....(text)	617, 636, 652-653
(color insert) Plate VIII, 638-679	
Brun, (Hon.) Constantin: Danish Minister,	
United States.....	497
Brunhild, in legend.....	5
Brusa, Turkey.....(color insert) Plates IV-VII, 540-557	
Brush-tongued Parakeets: Polynesia.....(color	
insert) Plate XIII, 402-419	
Ru Kemesh, Gulf of.....	151
Buchanan Bay, Ellesmere Island.....	503, 508
Bucket-fed babies (calves).....	ill. 608
Buckthorn Family (Glossy Buckthorn).....	45-46
(color insert) Plate VI, 46-71	
Buckwheat Family (Arrowleaf Tear-thumb).....	46
(color insert) Plate VII, 46-71	
Buddha, Giant head of: Kiating, China.....	ill. 339
Buddha, Living: Labrang monastery, China.....	343
345, 347	
Buenos Aires, Argentina, Great frigorificos at.....	597
Buerat el-Hsun, Tripolitania.....	ill. 149
Buffalo caravan: Manchuria.....	ill. 616
Buffalo dancers, Indian: Southwest.....	ill. 255
Buffalo, Water.....	ill. 611-613
Buffalo, Water (<i>Bos bubalus</i>): India.....(color	
insert) Plate V, 638-679	
Buffaloes are near relations in the <i>Bos</i> family.....	603
Bugloss, Vipers- (<i>Echium vulgare</i> L.).....	45
(color insert) Plate V, 46-71	
Building construction: Pacific Islands.....	ill. 391
Bulgaria, Crossing (by automobile).....	201-202, 204
ill. 208	
Bulgarian Automobile Association.....	204
Bull bats, Reference to.....	321
Bull-drawn milk cart: Scotland.....	ill. 698
Bull, Twisting the tail of a: Temple carving,	
Egypt.....	ill. 621
Bullet marks, Massacre Cave, Ariz.....	ill. 265
Bulletin board, Refugee: Greece.....	ill. 571
Bullfighter, Spanish: Madrid.....	ill. 706
Bullfighting: Europe.....	ill. 706, 707
Bullocks, Torch-bearing, employed by Hannibal.....	614
Bumstead, Albert H., Sun compass invented by.....	523
ill. 520	

	Page
Bunchflower Family (Devilsbit).....	46
(color insert) Plate VI, 46-71	
Bunker Hill Day, Reference to.....	482
Bunks, Coffinlike: <i>Rijn-Schelde</i> (Rhine River	
barge).....	1, 2
Buoy 2CB, off the Virginia coast.....	453
Burgundian court at Worms, Ancient.....	29
Burial bundles, Indian: Arizona.....	ill. 295, 297
Burial customs: American Indians.....	263, 264, 270
272-273, 274, 291-292, 293, ill. 236, 237, 240, 241, 255	
"Burial of the Hands": American Indians.....	291-292
Burials, Ancient human: Hawaiian Islands.....	81
Burnett, Burke, Texas cattleman.....	629
Burning of Smyrna (1922), Refugees at the.....	535
539, 540, 557, ill. 538, 558-562, 564-566	
Burrows, Bird: Hawaiian Islands.....	103-104, 108
Butchers' custom: Tripolitania.....(text)	154
Butchers' Guild, House of the: Germany.....	ill. 626
Butter, Bank notes printed in yellow signifying	
wealth in.....(text)	607
Butterfield Trail, N. Mex.....	317
Buzzards Bay, Mass.....(text)	392
Byer (Island), Old maps showed.....	107
Byrd, (Lieut. Commander) Richard E., jr. Fly-	
ing Over the Arctic.....	519
Byrd, (Lieut. Commander) Richard E., jr.: Mac-	
Millan Arctic Expedition.....	225, 349, 352, 473
475, 476, 479, 502, 505, 509, 510, 511, ill. 225, 520	
Byron, G. A., Reference to.....	358
Byron Settlement, Athens.....	590
Byzantine architecture, Cathedral of: Sofia, Bul-	
garia.....	ill. (aerial view) 208

C

Cabeza de Vaca, Alvar Nufiez, Reference to.....	623
Cabin boy, MacMillan Arctic Expedition: Ken-	
nett Rawson.....	ill. 224
Cable stations: Hawaiian Islands.....	77, 104, 106
Cacti: U. S. Southwest.....(color insert)	
Plates IX-XII, XIV, XV, 274-291	
Cadzw Cattle.....	605, 606, ill. 690
Cadzw Cow: Great Britain.....(color insert)	
Plate VI, 638-679	
Cadzw Forest, Lanarkshire, Scotland: Breed of	
cattle.....	605, 606
Café, Arab: Tripolitania.....	135
Café, Village: Yugoslavia.....	198
Caiques (gondolas of Constantinople).....(color	
insert) Plate II, 540-557	
Calcar, Germany.....	6
Calendar, Gutenberg's astronomical.....	20
Calif, Heeling a.....	ill. 598
California Fertilizer Company, San Bernardino.....	324
California gold-rush, Reference to the.....	570
Call of the western wild (cow).....	ill. 593
Camel, Blindfolded, grinding grain: Tripolitania.....	137
Camel caravan led by an ass: Near East.....(color	
insert) Plate XIII, 540-557	
Camel caravans: Asia Minor.....	211
Camel market: Tripolitania.....	ill. 158
"Camel's-hair" brushes, Cow's hair used to	
make.....	592
Camels, Police of the desert on: Iraq (Meso-	
potamia).....	ill. 190
Camp, Coffin-filled temple used as a: China.....	333
Camp, National Geographic Society's: Carlsbad	
Cavern, N. Mex.....	301
Camp, National Geographic Society's: Pueblo	
Bonito, N. Mex.....	229-230, ill. 229
Camp sites: New Mexico.....	319
Camps, Refugee: Near East.....	559, 561, 563
564, 574, 590, ill. 570, 572, 576, 582, 583, 586, 587	
Camps, Tanager Scientific Expedition: Hawaiian	
Islands.....	78, ill. 80, 108
Canada, Bats of.....	329
Canada: Cattle.....(color insert) ill. 689	
Canadian Government provision station: Arctic	
Regions.....	505
Canal, Grand: Venice.....	196
Canals: Europe.....	2, 3, 34, 37
Canals, Hand-dug: Pueblo Bonito, N. Mex.....	232-233
Canaries, Sand Island, Hawaiian Group.....	106
"Canary," or, Laysan Finch.....	85
Candles, Coconut oil used in.....(text)	374
Candle's Flame (<i>Fouquieria splendens</i>).....(color	
insert) Plate XIII, 274-291	
Candy, Pulling: China.....	ill. 335
Cane hut: Tripolitania.....	ill. 157
Cannes, France, Reference to.....	193
Cannibals, Bird: Bristle-thighed Curlews, Laysan	
Island.....	ill. 104

	Page		Page
Cannon Fiord, Ellesmere Island.....	475, 503, 507	Castle, Old: Tripoli.....	131, ill. 132, 136
Canoe dance, <i>Poi</i> , or: New Zealand.....	523, 532	Castles, Rhine River.....	1, 15, 39, 41
Canoe fleet, Tahitian.....	125	ill. 16, 23, 26, 27, 31, 38	
Canoe race: New Zealand.....	129-130, ill. 128	Casuarina trees: Hawaiian Islands.....	106
Canoes (kayaks): Rhine River.....	10, 20	Cat mascot: England to India Automobile Ex-	
Canoes, Outrigger: Rapa Island.....	426, ill. 383	pedition.....	191, 192-193, 211, 214
Canoes, Rob Roy: New Zealand.....	119	Cat mascots: U. S. Navy destroyers.....	ill. 452, 454
Canoes, South Sea Island.....	426, ill. 381, 383, 384, 391	Catalo (Cattle).....	644-645
Cañon del Muerto, Ariz.....	ill. 265-267, 292, 293, 295	Cathedral, Mangareva Island.....	419
297, (color insert) Plate VIII, 274-291		Cathedral of Saint Alexander Nevski, Sofia,	
Cañon del Muerto, Ariz.: Exploring in the Can-		Bulgaria.....	ill. (aerial view) 208
yon of Death. By Earl H. Morris.....	263	Cathedrals: France.....	(text) 32, 34, ill. (distant view) 32
Canyon Bat (<i>Pipistrellus hesperus</i>).....	330	Cathedrals: Germany.....	7, 20, 23, 29, ill. 8, 10, 11, 30
Canyon, Chaco: New Mexico.....	ill. 256	Cats, Birds believed to be destroyed by: Tahiti.....	393, 394
Canyon, Chaco: New Mexico: Everyday Life in		"Catted," Anchors are (naval term).....	(text) 442
Pueblo Bonito. By Neil M. Judd.....	227	Cattle and Their Place in the Human Scheme:	
Canyon, Guadalupe: Texas.....	ill. 317	The Taurine World. By Alvin Howard San-	
Canyon of Death, Ariz.....	ill. 265-267, 292, 293, 295	ders.....	591
297, (color insert) Plate VIII, 274-291		"Cattle Baron," An early: Richard King.....	627-628
Canyon of Death, Ariz., Exploring in the. By		Cattle census.....	(text) 594, 597, 637
Earl H. Morris.....	263	Cattle country: Texas.....	627-629
Canyons: U. S. Southwest.....	(color insert)	Cattle-growing industry: Australia.....	597
Plates I, III, VII, VIII, 274-291		Cattle not indigenous to the Western Hemisphere	623
Cape Alexander, Greenland.....	485	Cattle of the world.....	ill. 593-602
Cape Breton Island, Nova Scotia.....	482	604-616, 618-620, 622, 624, 625, 628, 631-636, 680	
Cape Charles Light, off the Virginia coast.....	453	681, 684-698, 700-706, 708, 709	
Cape Cod Canal (Mass.).....	430	CATTLE OF THE WORLD, THE. PAINT-	
Cape Cod Light, Mass.....	441	INGS BY EDWARD HERBERT MINER.	
Cape Cod (Mass.) Collar: Experiences on		COLOR INSERT. XX PLATES.....	638-679
Board a U. S. Navy Destroyer in a Wild		Cattle tick, Disease caused by the.....	629, 630, 704
Winter Storm. By Lieut. H. R. Thurber.....	427	Cattle trains, Loading: U. S. West.....	ill. 636
Cape Harrigan, Labrador.....	516	Cattle: United States.....	(text) 594, 597
Cape Harrison, Labrador.....	486	Cattlemen, Dry farmers rout: U. S. West.....	630-631
Cape Hatteras, N. C.....	463, 464	Caucasians, Polynesian types and.....	377
Cape Henry, Va.....	449, 453, 455	Cavalryman of Tripolitania.....	(color insert)
Cape Kenrick, Greenland.....	ill. 485	Plate I, 140-149	
Cape Mikkovik, Labrador.....	486	Cave Bat (<i>Myotis velifer</i>).....	330
Cape Muggford, Labrador.....	516	Cave-dwellings: Tripolitania.....	159-160, ill. 160
Cape Parry, Greenland.....	513	Cave, Massacre: Arizona.....	263, ill. 265
Cape Ras Ajir, Tunisia.....	151	Cave, Mummy: Arizona.....	264, 266, 272, 274
Cape Sabine, Ellesmere Island.....	503, 505, 521	ill. 268-271, 294	
523, 524, 527		Cave of Altamira, Spain: Prehistoric drawings ill.	682
Cape Sable, Nova Scotia.....	518	Cave pearls: Carlsbad Cavern, N. Mex.....	315-316
Cape Strawberry, Labrador.....	516	ill. 313	
Cape Thomas Hubbard, Axel Heiberg Island.....	503, 523	Cave, Pictograph: Arizona.....	293, ill. 292
Cape York, Greenland.....	498, 500	Cave sanctuary: Arizona.....	ill. 272
Caper Family (Spiderflower).....	46	Caves: Arizona, Northeastern.....	300
(color insert) Plate VII, 46-71		Caves: Carlsbad Cavern (New Mexico), Bats of	
Capitol Syndicate Outfit in the Panhandle		the. By Vernon Bailey.....	321
(X I T).....	629	Caves: Carlsbad Cavern (New Mexico), New	
Capitol, Texas State.....	ill. 174	Discoveries in. By Willis T. Lee.....	301
Carabinieri, Mounted patrols of the: Tripoli-		tania. Bats hang in colonies from cavern.....	323
tania.....	159	Ceilings, Bats hang in colonies from cavern.....	323
Caramanli family: Africa.....	140, 149	Celtic Shorthorn (Cattle).....	604, 605
Caramanli, Mosque of the family of: Tripoli.....	140	Cemetery, Fishermen's: Greenland.....	514
Caravan, Buffalo: Manchuria.....	ill. 616	Census, Cattle.....	(text) 594, 597, 637
Caravan, Camel: Near East.....	(color insert)	Central Railway Station, Cologne, Germany.....	ill. (aerial view) 8
Plate XIII, 540-557		Cereal production: Greece.....	561, 563
Caravan crossing a river: China.....	ill. 336	Ceremonial kivas: Pueblo Bonito, N. Mex.....	248-249
Caravans, Camel: Asia Minor.....	211	252, ill. 228, 230	
Carlsbad Cavern, N. Mex.....	ill. 303-315, 320	Ceylon, "Covered Wagon" in (native cart).....	ill. 614
(color insert) Plate XVI, 274-291		Chaco Canyon, N. Mex.....	ill. 256
Carlsbad Cavern, N. Mex.: Map (sketch).....	302	Chaco Canyon National Monument, New Mexico:	
Carlsbad Cavern (New Mexico), Bats of the.		Everyday Life in Pueblo Bonito. By Neil M.	
By Vernon Bailey.....	321	Judd.....	227
Carlsbad Cavern (New Mexico), New Discover-		Chad, Lake: Africa.....	151
ies in. By Willis T. Lee.....	301	Champions, Cattle.....	ill. 684, 685, 692
Carnival, Maori: New Zealand.....	(text) 128, 129	Channel, Rangitoto: New Zealand.....	ill. 124
ill. 125, 128, 129		Chaotung, China.....	331, 333, 334
Carolina-Jessamine (<i>Gelsemium sempervirens</i> (L.		Characteristics, English (Emerson).....	614-615
<i>Ait. f.</i>).....	72, (color insert) Plate XVI, 46-71	Charcoal, Filter made of.....	596
Carpet weavers: Yugoslavia.....	ill. 203	Charlemagne, Reference to.....	(text) 30
Carrier pigeons: MacMillan Arctic Expedition		Charleston Navy Yard: Boston.....	427, 433, 482, ill. 428
519-520, 522, ill. 524		Charting the course, on board a destroyer.....	ill. 431
Carrot, Common (<i>Daucus carota</i> L.).....	74	Château Hill, Nice (France) from.....	ill. 195
(color insert) Plate XX, 46-71		Chater, Melville. History's Greatest Trek: Greece	
Cart, Bull-drawn: Scotland.....	ill. 698	and Turkey Exchange Two Million of Their	
Carteret, (Philip), References to.....	358, 392	People.....	533
Carthaginians, Reference to the.....	614	Chater, Melville. Rediscovering the Rhine: A	
Carts, Ox: Europe.....	ill. 633, 700, 702	Trip by Barge from the Sea to the Headwaters	
Carved slab, Maori: New Zealand.....	ill. 126	of Europe's Storied Stream.....	I
Carving, Temple (bull): Egypt.....	ill. 621	Cheese-making, Rennet used in.....	596
Cascades: White Terraces, New Zealand.....	ill. 110	Chengtzu, China.....	337, 338, 347, ill. 340
Cask, Monster (famous Heidelberg tun): Ger-		Cherrapunji, Assam (India), Rainfall at.....	178
many.....	(text) 31	Chesapeake Bay, References to.....	451, 463
Cassirly, (Col.) Gordon. Tripolitania, Where		Cheyenne reservation (South Dakota).....	631
Rome Resumes Sway.....	131	Chicory Family (plants).....	46
Castle, Anatolian (Anatoli Hissar): Sweet		(color insert) Plates VIII, IX, 46-71	
Waters of Asia.....	(color insert) Plate III, 540-557	Child, a friend of the cow.....	ill. 592
Castle: Fort of Rumeli Hissar, Bosphorus Strait..		Child, Berber: Tripolitania.....	(color insert)
(color insert) Plate II, 540-557		Plate II, 140-149	
Castle of Flassons: France.....	193	Child life: Germany.....	ill. 18
Castle of Rheinstein: Germany.....	ill. 26		

	Page		Page
Child life: Italy.....ill.	198	Club of Jewish Youth: Tripolitania.....	138
Child life: Pueblo Bonito, N. Mex.....	240-241	Coal a child of the sun.....	177
Children, Martin, Texas cattleman.....	629	Coal, Fuel oil replacing: U. S. Navy.....(text)	463
Children, Eskimo: Arctic Regions.....ill.	489	Coal production: Ruhr district, Germany.....	6
	492, 496, 500-503	Cobbler, Ox: Japan.....ill.	708
Children: France.....ill.	197	Coblentz, Germany.....10, 11, 12, 14, 15, 16, 17, ill. 14, 15	
Children, Near East.....(color insert)		Cock, Fighting: Society Islands.....ill.	385
Children, Pottery making taught to: Pueblo		Coconut, Husking a: Pacific Islands.....ill.	357
Bonito, N. Mex.....	240	Coconut meat, Grating: Austral Islands.....(color	
Children, Rapa Island.....	419	insert) Plate VIII, 402-419	
Children, Refugee: Near East.....ill.	567	Coconut palm cultivation: Pacific Islands.....363, 369	
	572, 578, 581-583, 587-589		388, 389, 393, ill. 360, 374
Children's bodies buried like sardines.....	274	Coconuts without husks, Reference to.....	357
Children's paradise: Pacific Islands.....(text)	387	Coffee, Arabian: Near East.....(color insert)	
Chile, Rainfall in.....	179		Plate X, 540-557
Chillingham Bull: Great Britain.....(color insert)		Coffee cultivation: Pacific Islands.....363, 419, ill. 370	
	Plate VI, 638-679	Coffee pickers: Rapa Island.....ill. 370	
Chillingham Cattle.....	605, 606	Coffee shop, Desert Arabs outside a: Bagdad.....ill.	217
Chillingham Park (England), Herds at.....	605	Coleman Fulton Packing Co., Reference to the.....	628
China, Central: Experiences of a Lone Geog-		COLLARIN' CAPE COD: EXPERIENCES ON	
rapher: An American Agricultural Explorer in		BOARD A U. S. NAVY DESTROYER IN A	
Brigand-infested Central China. By Joseph F.		WILD WINTER STORM. BY LIEUTEN-	
Rock.....	331	ANT H. R. THURBER, U. S. NAVY.....	427
China: Map (sketch).....	334	Cologne Cathedral: Germany.....7, ill. 8, 10, 11	
Chinchbugs, Bats carry.....	322	Colonial troops, Italy's: Tripolitania.....(color	
Chinese molasses-candy pull: Szechwan.....ill.	335	insert) Plates I, IV, V, 140-149	
Chinese: Tahiti.....	389	Colonies, Polynesian, Ruins of: Hawaiian Islands	77
Chingchwan, China.....	337	Colony, Bird, Wedge-tailed Shearwaters, Laysan	
Chios, Island of (Greece).....	539, 581	Island.....ill.	95
Chisels, Clouds are the sun's.....	163	Color associated with holy men: Green.....(text)	
Chisholm, John, Texas cattleman.....	629		Plate IV, 540-557
Choni, Independent territory of (China).....	343, 346	Color photographers: MacMillan Arctic Expedi-	
	347, ill. 341-343	tion.....225, 226	
Choni, Prince of (China).....	342	Color hymn of light and water.....ill.	170
Chosen (Korea): An ox pulling an automobile		Colors, Arctic's, photographed for the first time.....	514-515
out of the mud.....ill.	694	Colors of the sky.....	189
Chosroes, Tomb of: Persia.....	222	Colorado River, Reference to.....	180
"Chow": Mealtime on board a destroyer.....ill.	448	Columbia River, Steamboat Rock formerly an	
Christ, Time of: Bagdad.....	220	island in the.....ill.	622
Christian refugees: Near East.....ill.	537, 582	Column, Winged lion: Venice.....ill.	199
Christian women: Near East.....(color insert)		Comanche Indians: U. S. Southwest.....245, ill.	257
	Plates XIV, XVI, 540-557	Comanche war parties from Texas plains.....	245
Christians and Moslems, Exchange of: History's		"Comet," bull of Shorthorn production.....	634
Greatest Trek (Near East). By Melville Chater		Commerce, Decline of: Constantinople.....(text)	
Christians, Pacific Islanders become.....384, 392, 419, 421			Plate VI, 540-557
Christmas day (1777), Captain Cook and.....	402	Common Amaranth (<i>Amaranthus hybridus</i> L.)... 44	
Christmas Island.....(text) 364, 386, 388, 390		(color insert) Plate II, 46-71	
	398, 402, ill. 364	Common Carrot (<i>Daucus carota</i> L.).....	74
Chungpa, China.....	337	(color insert) Plate XX, 46-71	
Chur, Switzerland.....	40, 41	Common Hop (<i>Humulus lupulus</i> L.).....	74
Church of Santa Maria della Salute: Venice.....ill.	199	(color insert) Plate XX, 46-71	
Church, Roman Catholic: Pacific Islands.....ill.	422	Common Lilac (<i>Syringa vulgaris</i> L.).....73-74	
Church service on deck: U. S. Navy.....ill.	446	(color insert) Plate XIX, 46-71	
Chuska Range: Arizona—New Mexico.....	263	Common Meadowbeauty (<i>Rhexia virginica</i> L.)... 73	
Cigarettes, American: Germany.....	14	(color insert) Plate XVII, 46-71	
Cilician Gates: Turkey.....	211	Common Sundrops (<i>Oenothera fruticosa</i> L.)... 71	
Circular boat (gufah), Constructing a: Bagdad.....ill.	216	(color insert) Plate XI, 46-71	
Cirro-cumulus clouds.....ill.	183	Common Woodrush (<i>Juncoides campestris</i> L.)	
Cirro-stratus clouds.....ill.	173, 182	Ktze.).....75, (color insert) Plate XXIII, 46-71	
Cirrus clouds.....180, ill. 181, 182		Communication, Arctic.....520, 522, ill. 524	
Citadel, Seven-walled: Persia.....	222	Communication, Means of: Flag signals.....431	
City Gate, Teheran: Persia.....ill.	218	ill. 430, 466, 467	
City gateway: Tripoli.....ill.	134	Communication, Means of: Tripolitania.....(text)	158
"City of the Seven Great Smells" (greeting):		Compass, Arctic exploration and the.....523	
Bagdad.....	217	"Composition," An accidental bit of: Sunset.....ill.	172
Civil War armies, Beef demands of the.....	620	Confluentes, Coblentz (Germany) formerly called.....	11
Clay, Clouds and.....	163	Conical Rock, Greenland.....(text) 487, 500	
Clay, Rolling, for pottery: Indian potter.....ill.	248	Connecticut River valley as a stock-breeding	
Clay, Rouge from: Pueblo Bonito, N. Mex.....238-239		region.....	633
Cleanliness among Indians: North America.....	253	Constantinople, Turkey.....191, 204, 205, 206-207	
Cleve, Germany.....	5	534, 540, 557, 559, 569, 577, 590, ill. 211, 578	
Cliff, Braced up: Pueblo Bonito, N. Mex.....ill.	235	Constantinople, Turkey.....(color insert)	
Cliff, Cwells: Austral Islands.....ill.	367		Plates II, III, VI, 540-557
Cliff dwellers, Sites for: Arizona.....(color insert)		Constitution (ship).....(text) 428	
	Plate VII, 274-291	Continental ("Mill Iron") Co. (cattle).....	629
Cliff dwellings, Prehistoric: Arizona.....ill.	268-271	Control room, U. S. S. Tennessee.....ill.	440
Cliffs: U. S. Southwest.....(color insert)		Cook, James, References to.....355, 358, 360, 380, 402	
	Plates I, III, VII, VIII, 274-291	Cookers, Fireless (Nature's): New Zealand.....127-128	
Climate: Polynesia.....	366, 369		ill. 117
Clock, Astronomical: Strasbourg Cathedral		Cookery, French.....	193
(France).....	34	Cookery, Tahitian.....	393
Clock, Cellar: Germany.....ill.	31	Cooking, Indian: U. S. Southwest.....ill.	250
Clock, Gate: Switzerland.....ill.	37	Cooking, Deck: Rhine River barge.....ill.	3
Clocks distribution, Refugee: Near East.....ill.	578	Coolidge, (President), Reference to.....	301
"Cloud of Islands" (Tuamotus).....	361	Coolies, South Sea Islands.....ill.	390
Cloudburst, Raindrops' size determines a.....	174	Copra industry: Pacific Islands.....ill. 357, 372, 374-376	
Clouds.....ill. 162, 164-166, 168-177, 179, 181-188		Copra schooners: Nukuhiva Island.....(color insert)	
Clouds, Toilers of the Sky. By McFall Kerbey.....	163		Plate II, 402-419
Club, Alwiyeh (British): Bagdad.....	219	Copper vessels: Tibetan kitchen.....ill.	346
Club, American Guernsey Cattle.....(text) 689		Coral blocks, Building with: Pacific Islands.....ill.	390
Club, Boys' and Girls' (Cattle): Exhibit.....ill.	687	"Coral Island" (book) by Ballantyne (1858).....	357

	Page
Coral islands, Pacific Ocean...	361, 363, 423, ill. 367
Coral reefs: Hawaiian Islands.....	82, 103, 107, 108
Coral rings (atolls): Pacific Ocean.....	363, 365-366
	369, 385
Coralbells (<i>Heuchera sanguinea</i> Engelm.).....	75
(color insert) Plate XXIII, 46-71	
Corn Belt cattle area: United States.....	637
Corn Belt meat packers: United States.....	597-598, 600
Corn cakes, Indian baking: New Mexico.....	ill. 250
Corn, Crows destroy.....	243
Corn, Cultivation of: Prehistoric Indians.....	299
Corn, Drying: Arizona.....	ill. 262
Corn greatest animal-fattening food.....	598
Corn-grinding Dance, Zufi Indians'.....	ill. 257
Corn-shelling, Neighborhood: Yugoslavia.....	ill. 206
Corn thousands of years old.....	270
Corned beef, Canning.....	628
Coronado and his <i>conquistadores</i>	232-233, 245, 254
Coronado, Francisco Vázquez.....	623-624
Coronado's "cows," Reference to.....	623-624
Coronas.....	(text) 182, ill. 177
"Correction" (ship).....	ill. 472
Corraia, José G., Reference to.....	389
Cost of living: Germany.....	ill. 3
Costume, Arabian: Bagdad.....	ill. 217
Costume, Arctic.....	515, 531, ill. 483
	487, 488, 490-494, 499-503
Costume, Black Forest region: Germany.....	ill. 34, 35
Costume, Devil dancers': Choni (China).....	ill. 343
Costume, Greek: Greek colonies.....	ill. 535
Costume, Greenlanders'.....	ill. 483, 508, 509, 510
Costume, Hopi Indian girl.....	ill. 258
Costume, Indian Buffalo dancer's: Southwest.....	ill. 255
Costume, Jewish: Tripolitania.....	137-138, ill. 151
Costume, Maori: New Zealand.....	ill. 125-139
Costume, Near East.....	(color insert)
	Plates I, IV, V, VII-XVI, 540-577
Costume, Tibetan chief's.....	ill. 342
Costume, Tibetan woman's.....	ill. 341
Costume: Tripolitania.....	(color insert)
	Plates I-VIII, 140-149
Costume, Turkish.....	ill. 205, 212
Costume, Yugoslavia.....	ill. 204
Cotton cloth, Fragments of: Pueblo Bonito, N. Mex.	237-238
Cotton cloth, Manchester: Pacific Islands.....	ill. 386
Cours Saleya, Nice, France.....	ill. 196
Court, Mosque: Near East.....	(color insert)
	Plate XII, 540-557
Courtellemont, Gervais. Illustructor. Sun-painted Scenes in the Near East. (Autochromes Lumière).....	(color insert) XVI plates, 540-557
Courtesy, Turkish.....	205, 209
Courtyard, Syrian home.....	(color insert)
	Plate XII, 540-557
Courtyard, Turkish home and.....	(color insert)
	Plate VIII, 540-557
Covered Wagon in Ceylon, The.....	ill. 614
Cowbells.....	603, ill. 601, 607
Cowboys: U. S. West.....	624, 627, ill. 595, 598
	624, 625, 636, 680, 681
Cows.....	(color insert)
	Plates VI, VIII, IX, XII, XIII, XIV, 638-679
Cows, Sacred.....	604, 610
Coyote pups, Indian children made pets of.....	241
Coyotes: New Mexico.....	317
Crabs, Land: Christmas Island.....	402
Crag-swallows, Tahitian (birds).....	394
Crampton, (Prof.) Henry E., Reference to.....	363
Creeks, Hot-water: New Zealand.....	(text) 500
Crimson Cliffs, Greenland.....	ill. 123
Croatia, References to.....	ill. 198, 201
Croats, References to the.....	ill. 198, 201
Crocker Land Expedition of 1913-1917.....	478
Crow's nest of a ship.....	454, 455, ill. 432
Crows, Pests of: Pueblo Bonito, N. Mex.....	243
Crusades, References to.....	10, 15
Crystal Palace Cliffs, Greenland.....	ill. 485
Ctesiphon, Mesopotamia.....	220
Cuba, With the Fleet off for.....	462-464
Cuckoo, Parasitic: Polynesia.....	(color insert)
	Plate XII, 402-419
Cucumber, Mock (<i>Echinocystis lobata</i> T. and G.).....	72
(color insert) Plate XIV, 46-71	
Cud-chewing habit, Animals that have the.....	596-597
"Cud," Why a cow chews her.....	596-597
Culiacán, Mexico.....	247
Cult, South Sea.....	357
Cumulo-nimbus clouds.....	ill. 188
Cumulus clouds.....	180, ill. 168, 175, 187
Curlews, Bristle-thighed (birds): Laysan Island.....	ill. 104
Currant, Wax (<i>Ribes cereum</i> Douglas).....	71
(color insert) Plate XIII, 46-71	

	Page
Currency, Silver: China-Tibet.....	347
Currency, Turquoise used as: Pueblo Bonito, N. Mex.	245-246
Current observations: MacMillan Arctic Expedition.....	354
Current, Rhine River ferry carried by the.....	ill. 36
Curtice, (Dr.) Cooper, U. S. Bureau of Animal Industry.....	630
Customs officials: Europe.....	2-3, 5, 34, 41
Cyclades (Greece).....	(text) 581
Cyrenaica (Province): Africa.....	149, 151
Cypress trees: Turkey.....	(color insert)
	Plate VII, 540-557
D	
Dairy cows.....	617, 636-637
	ill. 596, 628, 631, 685, 692, 693, 703
Dairy shop: Nice, France.....	ill. 196
Dakar, Senegal.....	151
Damascus, Syria.....	214, ill. 213, 214
Damascus (Syria), Types from.....	(color insert)
	Plates IX, XV, XVI, 540-557
"Damask," Origin of the word.....	(text) 214
Dance, Bird: Laysan Island.....	ill. 105
Dance, Corn-grinding: Zufi Indians.....	ill. 257
"Dance of Death!": Burning of Smyrna (1922).....	539
Dance, <i>Poi</i> , or canoe: New Zealand.....	ill. 125
Dance, War: Comanche Indians.....	ill. 257
Dance, War: New Zealand.....	ill. 128, ill. 129
Dancers, Buffalo: American Indians.....	ill. 255
Dancers, Devil: Choni (China).....	ill. 343
Dances, Ceremonial: Tahiti.....	396
Dances, Negro: Tripolitania.....	139-140
Dancing girl, Takarua.....	ill. 386
Dandelion (<i>Leontodon taraxacum</i> L.).....	46
(color insert) Plate IX, 46-71	
"Dangerous Islands": Tuamotu Archipelago.....	(color insert) Plate V, 402-419
Dardanelles, Reference to the.....	557
Darius, King of Persia.....	211
Dark Tickle, Labrador.....	ill. 495
Darkness, Cavern, Affect upon men.....	301-302
Darwin, (Charles), References to.....	358, 365
Dasht-i-Kavir (dry salt area), Persia.....	220
Dasht-i-Lut Desert, Persia.....	220, ill. 220, 221
Date Palm trees: Tripolitania.....	ill. 156
Davidoff, (Dr.) Leo M.: MacMillan Arctic Expedition.....	349, 354
Death, Canyon of (Cañon del Muerto, Arizona): Exploring in the Canyon of Death. By Earl H. Morris.....	263
Death mask, Beethoven's: Germany.....	9
Death rate, Greek refugee: Near East.....	559, 563
"De Bello Gallico," Caesar in.....	604
Decatur, (Commodore Stephen).....	(text) 133
Decorations, Maori: New Zealand.....	ill. 126
Deck laundry: Sailors washing their clothes.....	ill. 444
Deck, Washing the: U. S. Navy destroyer.....	ill. 468
Dedeagath (Greece), Reference to.....	557
Defensive wall of Tripoli.....	ill. 156
Delhi (India), Sack of.....	222
Demavend, Mount: Persia.....	(text) 218
Denmark and Dairying.....	664
Denmark, Cattle from: New England.....	633
Densities, Sea water.....	354
Deptford, England, Cattle industry at.....	598
Dervishes, Monastery for: Turkey.....	(color insert)
	Plate XII, 540-557
Dervishes, Whirling: Asia Minor.....	210, ill. 212
Desert, Camels ready for a journey into the: Near East.....	(color insert) Plate XIII, 540-557
Desert, Dasht-i-Lut: Persia.....	ill. 220, 221
Desert Flowers: U. S. Southwest.....	(color insert)
	Plates IX-XV, 274-291
Desert Gods, Playground of the.....	(color insert)
	Plate II, 274-291
Desert islands caused by rabbits.....	86, 103-104
Desert, Libyan: Wandering sand hill.....	ill. 158
Desert plants, Edible seeds from.....	231
Desert police: Iraq (Mesopotamia).....	ill. 190
Desert, Salt (Kum): Persia.....	222
Desert scenes: U. S. Southwest.....	(color insert)
	Plates I-III, V-VIII, XII, 274-291
Desert, Syrian.....	211, 214-215, 219
Desertcraft of the nomad.....	215
Deserts, Clouds and.....	177, 178, 180
Deserts, Persian.....	220, 222, ill. 220, 221
Destroyer, U. S. Navy: Collarier' Cape Cod. By Lieut. H. R. Thurber.....	427
Destroyers, U. S. Navy.....	ill. 428-439, 442, 444-449
	451, 453, 456-472
Deutz, Germany.....	ill. (aerial view) 8

Page

Devil dancers, Choni (China).....ill.

"Devil's Porridge Pot" (boiling mudhole): New Zealand

Devilsbit (*Chamaelirium obovatum* Small).....

Devons (Cattle)629, 636, 677, 679

Devonshire (England), Cattle shipment from (1624)

Dexters and Kerries (Cattle).....687-688, 693

Diadem (pinnacle): Tahiti.....394, 396, ill.

Diapensia Family (Pyxie).....

(color insert) Plate IX, 46-71

Dickey, Donald R., member of the Tanager Scientific Expedition

Dido, Queen, Reference to.....

Dikes: Europe

Disease, Cattle: Texas fever.....629, 630

Disentis, Switzerland

Dishley experiments (cattle).....620-621

Disko Bay, Greenland.....(text) 484

Disko Island, Greenland.....(text) 484, 497

Divorce, Moslem

Djerba, Island of: Tunisia.....(text) 133

Dodge's Mountains, Greenland, ill. (distant view)

Dog chorus, "Husky": Labrador.....(text) 478

Dog-driver, Woman

Dog mascot: U. S. Navy destroyer.....ill.

Dog remains king of the Arctic, The.....

Dog sleds: MacMillan Arctic Expedition.....

Dogs, Eskimo: Arctic Regions

Dogs, Polynesian Navigators carried.....

Dogs, Starving: Bagdad.....

Dogwood, Flowering

(color insert) Plate X, 46-71

Doll, Indian child's: Pueblo Bonito, N. Mex.....

Dom (cathedral): Cologne, Germany.....ill.

(aerial view)

Dome Room, Carlsbad Cavern, N. Mex.....312-313

ill. 308, 314

Dome Room, Carlsbad Cavern, N. Mex.....(color insert) Plate XVI, 274-291

Domestication of wild cattle

Domino Run, Labrador

Dortmund, Germany

Dortmund Union Steel Works: Germany.....ill.

Doves (rock formation): Carlsbad Cavern, N. Mex. ill.

Downy Hawthorne (*Crataegus mollis* (T. and G.) Scheele).....45, (color insert) Plate III, 46-71

Dowsett Reef, Hawaiian Group

Draft oxen: San Marino.....ill.

Dragut, Mosque of: Tripoli.....(text) 133

Dragoman Pass, Bulgaria

"Drags" (cattle)

Dragut, Pirate: Tripoli

Drainage, Street: Turkey

Plates IV, VII, 540-557

Drama (Greece), Tobacco field at

Dream that came true, A: MacMillan Arctic Expedition

Driptide, Curtain of: Carlsbad Cavern, N. Mex. ill.

Drum, Minstrel of Libya and his

Drummer of Graibi (Ariz.), Indian

Drusus Bridge, Bingen, Germany

Drusus, Nero Claudius (38-9 B. C.): Roman general

Dry farmers rout cattlemen: U. S. West.....630-631

Drying corn: Arizona

Drying peaches: Arizona

Ducie Island, Pacific Ocean.....388, ill.

Duck (Laysan Teal): Hawaiian Islands

Duels, Heidelberg's students fight

Duisburg, Germany.....

Dumont d'Urville, (Jules), Reference to.....358

"Durham" (cattle).....591, 627

Düsseldorf, Germany

Dust a menace to life

Dust, Clouds and

Dutch Belted (Cattle).....657, 660

(color insert) Plate IX, 638-679

Dutch East Indies: Cattle

Dutch landmarks (windmill and cow).....ill.

Dutchmans-breeches (*Dicentra cucullaria* Bernh.)

71, (color insert) Plate XII, 46-71

Dwarf Ginseng (*Panax trifolium* L.).....

(color insert) Plate XIII, 46-71

Dyes, coal-tar: Basel, Switzerland

Page

E-took-a-shoo (Eskimo) takes his first airplane ride

Eagle feathers, Evil spirits kept away with: Pueblo Bonito, N. Mex.....

Ear trumpets, Beethoven's

Ears, Bat's

East (Near): Greece and Turkey Exchange Two Million of Their People. By Melville Chater..

East (Near), Sun-painted Scenes in the....(color insert) XVI plates, 540-557

Easter Island (Rapanui)

Eastern Island, Hawaiian Group

Eastern Scheldt (River), Lagoon-like

Eaton, Mary E. Illustrator. (wild flower paintings).....(color insert) XXIV plates 46-71

Economic necessity, Exchange of population was an: Greece-Turkey

Egg, Bird stealing an: Laysan Island.....ill.

Egg, Limb of a tree used as a nest for Fairy Tern's (bird).....ill.

Egg, Love Tern's single: Rock-ledge nest....ill.

Egypt: Carving in the Temple of Seti I.....ill.

Ehrenbreitstein, Fortress of: Germany.....ill.

Ehrenfels Castle (ruins): Germany.....ill.

Eiao Island, Marquesas.....ill.

Elburz Mountains, Persia.....ill. (distant view)

Electric cars: Belgrade, Yugoslavia

Electric fan: MacMillan Arctic Expedition equipment

Electric milking machine

Electricity: Basel, Switzerland

Electricity, Sources of.....177, 180

Elk calves, Foster mother nursing.....ill.

Ellesmere Island, Arctic Regions.....475, 502, 503, 509, 521, 522, 524-526, 527, 528, 532, ill.

Ellesmere Island region: Map (inset) Supplement. November, 1925

Ellice Islands

Ellis, William, References to

Eltz, Counts of: Ancestral home (Schloss Eltz)

Emerson, (Ralph Waldo), References to.....614, 621

Emmerich, Germany.....

Energy, Sources of.....177, 180

Engine telegraph (instrument): U. S. Navy destroyers

Engineering, Ancient American: Pueblo Bonito, N. Mex.....

England

England to India by Automobile. By Maj. F. A. C. Forbes-Leith.....

England to India: Map (automobile route)....

England's love of roast beef.....

English Longhorn (Cattle)

"Epic of fire, An": Burning of Smyrna (1922)..

"Epic of rain, An": Trekking refugees, Near East

Epirotes, Greek

Epirus (Province), Greece.....

Equator, References to the.....163, 178

Equipment: England to India Automobile Expedition

Equipment, Naturalist's: Arctic Regions.....350-351

Erosion, Clouds effect

Eskimo air guide: Greenland

Eskimo dogs

Eskimo history: Labrador

Eskimos, Smith Sound, Greenland

Essen, Germany

Esther, Tomb of (alleged): Persia.....

Etah Fiord, Greenland

Etah, Greenland.....473, 475, 478, 499, 500, 510, 511, 519, 520, 521, 522, 527, 532, ill. 490, 496, 521-525

Etah, Greenland, MacMillan Arctic Expedition base

Etah Harbor, Greenland

Etritean troops: Tripolitania.....131, 132

Eudoxia, Princess of Bulgaria.....

Euphrates (River), Mesopotamia

Eureka Sound, Ellesmere Island

European quarter, Tripoli's new.....131, ill.

European War: Bagdad.....

European War—Near East: History's Greatest Trek. By Melville Chater.....

European War: South Sea Islands.....ill.

Evaporation, Clouds and.....(text) 162

163, 164, 168, 171, 178

(color insert) Plate XI, 46-71

Evening-primrose Family (Common Sundrops)...

(color insert) Plate XI, 46-71

	Page
Everlasting, Pearl (<i>Anaphalis margaritacea</i> (L.) Benth. and Hook.).....	44-45
(color insert) Plate II, 46-71	
EVERYDAY LIFE IN PUEBLO BONITO: AS DISCLOSED BY THE NATIONAL GEO- GRAPHIC SOCIETY'S ARCHEOLOGIC EX- PLORATIONS IN THE CHACO CAYON / NATIONAL MONUMENT, NEW MEXICO. BY NEIL M. JUDD.....	227
Evil, Bats celebrated as emblems of.....	321
Evil spirits, Eagle feathers used to keep away: Pueblo Bonito, N. Mex.....	252
Evolution, Human.....	9
Evzone, highland trooper of Greece.....	574
Expedition against the Navajo (1849), Punitive.....	245
Expedition, American Museum of Natural His- tory: Arizona.....	264
Expedition, Crocker Land: 1913-1917.....	478
Expedition, Italian automobile: Tripolitania.....	149, 151
Expedition, MacMillan Arctic.....	224-226
Expedition, MacMillan Arctic.....	225
Expedition, MacMillan Arctic. By Donald B. MacMillan.....	477
Expedition, MacMillan Arctic: MacMillan in the Field.....	473
Expedition, MacMillan Arctic: Scientific Aspects.....	349
Expedition, Pueblo Bonito (New Mexico): Na- tional Geographic Society. By Neil M. Judd.....	227
Expedition, <i>Tanager</i> Scientific: Hawaiian Islands. By Alexander Wetmore.....	77
Expedition, Whitney South Sea.....(text)	364
384-385, 388, 389, 402, 419, 423, 424-426, ill. 425,	426
EXPERIENCES OF A LONE GEOGRAPHER: AN AMERICAN AGRICULTURAL EX- PLORER MAKES HIS WAY THROUGH BRIGAND-INFESTED CHINA EN ROUTE TO THE AMNE MACHIN RANGE, TIBET. BY JOSEPH F. ROCK.....	331
Exploration, Arctic: Flying over the Arctic. By Lieut. Commander Richard E. Byrd.....	519
Exploration, Geographical.....	229
EXPLORING IN THE CANYON OF DEATH (ARIZONA): REMAINS OF A PEOPLE WHO DWELT IN OUR SOUTHWEST AT LEAST 4,000 YEARS AGO ARE RE- VEALED. BY EARL H. MORRIS.....	263
Export, Cattle: United States.....	598
F	
Faaite Island, Tuamotu Group.....	387
Fairbanks, Douglas: Paris.....	192
Fairy Tern (bird) and nest: South Sea Islands (text) 399, ill. 399, 401	
Fakarava Island, Tuamotu Group.....	423, 426
Falcons, Arctic.....	520
Fan, Electric: MacMillan Arctic Expedition.....	515
ill. 493	
Faneuil Hall (Boston), Market place removed to (1742).....	634
"Fantai" of a destroyer.....	457, ill. 437
Farm, Refugee relief: Turkey.....	582
Farmer, Yugoslavian farm and.....	206
Farmers, Greek: Near East.....	540, 577
Farmers, Persian, hard-working but cheery.....	222
Farmers, Turkish: Near East.....	540
Farmers, Women: Germany.....	ill. 7, 13, 18, 22
Farming, Oxen and.....	610-611, ill. 634, 709
Fatuhiva, Isle of: Marquesas.....	ill. 368, 377
(color insert) Plates II, VI, 402-419	
Fauna, Arctic.....	350
Feast, Progressive: South Sea Islands.....	419
424-425, ill. 425	
Feast, Sunday: Rapa Island.....	419, 424-425
Feather trade: Hawaiian Islands.....	86
Feathers, Divesting a tropic bird of its decorative red.....	395
Feathers, Indians trading with tropical-bird.....	247
Feeding her young, Mother-bird (by regurgita- tion).....	82
Feeding, Stall (cattle).....	634
Fei (mountain bananas): Pacific Islands.....	370
394, 396, ill. 385	
"Felix," cat mascot: England to India Auto- mobile Expedition.....	191, 192-193, 211, 214
"Felix the Second" (automobile).....	191
ill. 208, 220, 221	
Fencing, Barbed-wire, for cattle.....	629
Ferns, Tropical: Polynesia.....	369, 419
Ferris, (Miss): International Grenfell Hospital, Labrador.....	353

	Page
Ferry, Basel's (Switzerland).....	37, ill. 36
Ferry, Rhine River: Switzerland.....	37, ill. 36
Fertilizer, Guano as a.....	323, 324, 326
Festival, Maori: New Zealand.....(text)	128, 129
ill. 125, 128, 129	
Festival, Negro: Tripolitania.....	140, ill. 153
Festival, New Year's: Island of Bali.....	ill. 697
Festivals, Herds were partners in the gala (among the ancients).....	610-611
Feudal system: Persia.....	221, 222
Fezzes, Soldiers wearing: Tripolitania.....(color insert) Plate V, 140-149	
Fiat automobiles: Tripolitania.....	149
Fig trees: Rapa Island.....	419
Figwort Family (flowers).....	71, (color insert) Plate XI, 46-71
Fiji Islands, References to the.....	373, 385
Finch, Nihoa (bird): Nihoa Island.....(text)	76, 77-78
Finches, Laysan: Hawaiian Islands.....	85, 103, 106
Finger prints, Indian: Pueblo Bonito, N. Mex.....	240
Fire-fighting equipment: Smyrna.....	ill. 566
Fire, Smyrna: Turkey.....	ill. 538
Fire warning custom: Turkey.(text) Plate III, 540-557	
Fireless cooker, Principle of the: Tahiti.....	393
Fireless cookers, Nature's: New Zealand.....	127-128
ill. 117	
Fireplace, Indian: U. S. Southwest.....	253, ill. 250
Firewood supply, Pueblo Bonito, N. Mex.....	230
First-born in his cradle: Turkey....(color insert) Plate I, 540-557	
Fish: Arctic Regions.....	225
Fish, Birds catching: Hawaiian Islands.....	ill. 83
Fish-drying platforms: Labrador.....	ill. 478
(distant view)	
Fish, Flying, Vapor molecules like.....	163, 167
Fish, Net of: Hawaiian Islands.....	ill. 85
Fish, Preparing: Labrador.....	ill. 473
Fish specimens: MacMillan Arctic Expedition	350, 351
Fish: Tunny, caught near Christmas Island.....	ill. 364
Fishermen, Halibut: Greenland.....	514
Fishermen, Native: Pacific Islands.....	ill. 359
Fishermen, Salmon: Germany.....	ill. 20, 21
Fishing boat, Rhine River.....	ill. 21
Fishing boats: Turkey.....(color insert) Plate II, 540-557	
Fishing canoe, Shell-decorated: Samoa.....	ill. 391
Fishing for bodies: Smyrna.....	539, ill. 505
Fiume, Italy.....	197-198, 201, ill. 202
Flag, Church, on board U. S. Navy destroyer.....	446
Flag, National Geographic Society: MacMillan Arctic Expedition.....	517, ill. 226, 517
Flag, Storm warning.....	427
Flag, Triangular yellow cloth: Protection against bandits (China).....	ill. 333
Flag, Tribal: Iraq (Mesopotamia).....	ill. 190
Flag, U. S. Coast and Geodetic Survey: Green- land.....	ill. 490
Flag, U. S.: MacMillan Arctic Expedition.....	517, ill. 517
Flageolet, Reed (musical instrument): Tripolitania	132
Flagler Fiord, Ellesmere Island.....	505, 507, 526, 529, 531
Flags, Italian colonial soldiers with their: Tripolitania.....(color insert) Plate V, 140-149	
Flags, Signaling with: U. S. Navy.....	ill. 430
ill. 466, 467	
Flags, U. S., on Greek ships.....	540, 559
Flagstaff Tickle, Labrador.....	486, 493
Flame Azalea (<i>Azalea lutea</i> L.).....	72
(color insert) Plate XV, 46-71	
Flassons, Castle of: France.....	193
Fleischbank (Meat Hall), Stone ox over the en- trance to: Germany.....	ill. 626
Flesh-bearers (cattle).....	606, 617, 620, 621
Flies, Biting: Pacific Islands.....	373
Flight, Bat's powers of.....	321, 322-323, 330
Flightless Rail (bird): Hawaiian Islands.....	85, 106
Flood irrigation: New Mexico.....	233, ill. 260
Floods caused by Alpine snows: Rhine River.....	36, 37
Floor, Settling of the: Carlsbad Cavern, N. Mex.	315
ill. 304	
Flora, Arctic.....	350
Flora: Polynesia.....	369-371
Flour, American refugee relief: Smyrna.....	ill. 564
Flowers, Arctic.....	225
Flowers, Desert: U. S. Southwest.....(color insert) Plates IX-XV, 274-291	
Flowers of North America, Wild.....(color insert) XXIV plates, 46-71	
Flowers, Wild: Pages From the Floral Life of America.....	44

	Page		Page
Flowering Dogwood (<i>Cornus florida</i> L.).....	47, 71	Fruit market: India.....	223
(color insert) Plate X, 46-71		Fruit Pigeons: South Sea Islands..(color insert)	
Flowstone, Terraces of: Carlsbad Cavern, N. Mex.	309	Plates X, XI, 402-419	
Flutes, Prehistoric.....	292, 293	Fruit venders, Syrian.....(color insert)	
FLYING OVER THE ARCTIC. BY LIEUT.		Plate XI, 540-557	
COMMANDER RICHARD E. BYRD, U. S.		Fruits, Tropical: Pacific Islands.....	370-371
NAVY.....	519	373, 393, 394	
Flytrap, Venus (<i>Dionaea muscipula</i> Ellis).....	75	Fuel gatherers: Choni (China).....	341
(color insert) Plate XXIV, 46-71		Fuel oil replacing coal in the Navy.....(text)	463
Fodder stacks: Yugoslavia.....	206	Fueling at sea, Destroyer.....	462
Fog made close to the earth.....	167, 180, ill. 177	Fujiyama (Japan), Hood cloud topping.....	179
Fogs: Rhine River region.....	39, 40	Fukiang River, China.....	336
Folkstone, England.....	191	Fumitory Family (Dutchmans-breeches).....	71
Food, Desert plants furnish.....	231	(color insert) Plate XII, 46-71	
Food supply, Bonitians': New Mexico.....	231-232	Funafuti, Atoll of: Pacific Islands.....	366
Food supply: Indians, Prehistoric.....	299	Funereal offerings: American Indians.....	270
Food supply, National Geographic Society's Carls-		272, 274, 291-292, 293	
bad Cavern Expedition.....	301	Fur, Bats are clothed in.....	321
Food supply: Pacific Islands.....	370, 419, 424-425	Fust, Johann: Germany.....	21
ill. 356, 357, 364, 370, 372, 374-376, 380-383, 385, 425			
Food supply, Pueblo Bonito (N. Mex.) Expedition	229		
Food supply: South Sea Islands.....(color insert)			
Plates VIII, XIV, 402-419			
Foot-racing: New Zealand.....	129		
Footgear, Arctic.....	ill. 483		
491, 494, 499, 501, 502, 508-510			
Footgear, Tibetan.....	ill. 341, 342		
Forbes-Leith (Maj.), F. A. C. From England to			
India by Automobile.....	191		
Ford (automobile), Exploring in a: South Sea			
Islands.....	398, 402		
Ford automobile: Tripolitania.....	149		
Ford, (Henry), factory in Trieste.....	197, 200		
Fording Milk River (Mont.), Cattle.....	ill. 625		
Forests: Melanesian isles.....	373		
Forster, (Johann), Reference to.....	358		
Fort of Rumeli Hissar, Bosphorus Strait.....(color			
insert) Plate II, 540-557			
Forteau Bay, Labrador.....	ill. 353		
Fortifications, Polynesian: Rapa.....	419, ill. 420		
Fortifications, Pueblo Bonito's (New Mexico)...	245		
Fortress of Ehrenbreitstein, Germany.....	11, ill. 12		
Foulke Fiord, Greenland.....(text)	488		
Fountain, Gutenberg Monument: Germany.....	29		
Fountain, Nectar: Carlsbad Cavern, N. Mex.....	315		
316, ill. 310			
Fountain, Wine: Römerberg.....	23		
Fount-o'clock Family (Heartleaf Umbrella-wort)...	71		
(color insert) Plate XII, 46-71			
Fourleaf Milkweed (<i>Asclepias quadrifolia</i> Jacq.)			
73, (color insert) Plate XIX, 46-71			
Fracto-cumulus clouds.....	180, ill. 170, 173		
Fracto-stratus clouds.....	188		
Fram (ship), Reference to.....	505		
France, Crossing (by automobile).....	191-193, ill. 194-197		
France, References to.....	6, 34, 35, 39		
France (schooner): Whitney South Sea Expedi-			
tion.....	385, 388, 402, 425, 426		
ill. 368, 376, 393, 399, 423			
France: White Oxen.....	ill. 698		
Francis, Albert, aérographer, MacMillan Arctic			
Expedition.....	349, 352, 353, 354, 486, 519-520, 527,		
532, ill. 489, 524, 528			
Frankfort-on-the-Main, Germany.....	20		
21, 22, 23, 26, 35, 36, ill. 29, 30			
Franz Josef Land: Map (inset) Supplement, No-			
vember, 1925			
Frauenlob, von Meissen known as.....	20		
Free-tailed or Guano Bat.....	323, 328, 330, ill. 325, 327		
Fregata (Frigate Bird): Hawaiian Islands.....(text)	89		
French Canadian (Cattle).....	679, 683		
French Frigate Shoal, Hawaiian Group.....(text)	79, 82		
French Ox team.....	ill. 634		
French quarter, Strasbourg's old.....	ill. 32		
French soldiers: Germany.....	ill. 14		
Fribourg (Cattle).....	653		
Friend of the cow, A (child).....	ill. 592		
Friesian (Cattle).....	617, 636		
Frigate Birds (Man-of-war Birds).....	78, 103, 402		
ill. 83, 88, 89, 106, 364, 394, 395, 397			
Frigoríficos, Buenos Aires.....	597		
Fringed Bats (<i>Myotis thysanodes</i>).....	339, ill. 324		
Fringed Polygala (<i>Polygala paucifolia</i> Willd.)...	73		
(color insert) Plate XVIII, 46-71			
Frogs: South Sea Islands.....	373		
FROM ENGLAND TO INDIA BY AUTOMO-			
BILE: AN 8,527-MILE TRIP THROUGH			
TEN COUNTRIES, FROM LONDON TO			
QUETTA, REQUIRES FIVE AND A HALF			
MONTHS. BY MAJOR F. A. C. FORBES-			
LEITH.....	191		
Galabès, Tunis.....	151		
Galata bridge, Constantinople.....	557		
Galata hill, Constantinople.....	557		
Galata quay, Constantinople.....(color insert)			
Plate VI, 540-557			
Galápagos Islands, Reference to.....	373		
Galloways (Cattle).....	707-708, ill. 692		
Gallup, N. Mex.....(text)	229, 230, 257, 291, ill. 257		
Gambier Group, Tuamotu Archipelago.....	419		
Game (wild), market: Nice, France.....	ill. 196		
Gardeners, Chinese: Tahiti.....	389		
Gardener Island, Hawaiian Group.....(text)	79, 82		
ill. 81			
Gas mask, Excavator wearing a: Arizona.....	ill. 294		
Gas masks, U. S. Navy destroyers equipped with	467		
Gas-swept region: New Zealand.....	ill. 118		
Gas, Water molecules become.....	167, 170		
Gasoline supply: Carlsbad Cavern, N. Mex.....	302		
Gate, Castle: Tripoli.....	ill. 136		
Gate, City, Teheran, Persia.....	ill. 218		
Gate, Ishtar: Babylon.....	220		
Gate, Old (Spalanthor): Switzerland.....	ill. 37		
Gateway, Tripoli city.....	ill. 134		
Gateway, Whalebone: Greenland.....	ill. 503		
Gauguin, Paul, Reference to.....	357		
Gaur (<i>Bos gaurus</i>): East India.....	638, 640		
(color insert) Plate I, 638-679			
Gaur, wild ox of Asia.....	604		
Gayal (Cattle).....	604		
Gayer, Jacob: MacMillan Arctic Expedition.....	479		
510, 514, 515, 532, ill. 493			
Geckos, Clinging-footed: Polynesian reptiles.....	373		
Geese, Girl tending: Rhine Valley.....	41, ill. 40		
Genoa, Italy.....	194, ill. 198		
Gentian Family (Rosegentian).....	71		
(color insert) Plate XII, 46-71			
Geographer, Experiences of a Lone: An American			
Agricultural Explorer in Brigand-infested Cen-			
tral China. By Joseph F. Rock.....	331		
Geographic names: France.....	34		
Geographic names: Germany.....	9, 11, 17		
Geographic names: Holland.....	3		
Geography: Polynesia.....	360-361, 363, 365-366		
George III, King of England.....	620		
Gerardia, Holms (<i>Agalinis holmiana</i> (Greene) Pen-			
nell).....	71, (color insert) Plate XI 46-71		
German Southwest Africa, Arid region that was.....	180		
Germany: Rediscovering the Rhine. By Melville			
Chater.....	1		
Germany.....	I, 5-7, 9-11, 14-15, 17, 19-23		
26-27, 29-30, 34, 35, 37, 39, ill. 4-8, 10-31, 601, 626			
Geronimo (Apache chief) and his outlaw band.....	243		
"Geronimo" (Texas Longhorn).....	710, ill. 705		
Geyser Valley, New Zealand.....	ill. 114, 115, 122		
Geyser, World's Greatest: Waimangu and the Hot			
spring Country of New Zealand. By Joseph C.			
Grew.....	109		
Geysers: New Zealand.....	109, 113, 116-117, 123, 127, 130		
ill. 111, 112, 114, 122			
Ghadames, Tripolitania.....	149, 151		
Gharyan (Garian), Tripolitania.....	157, 159, 160, ill. 159		
Giant Ox (<i>Bos taurus primigenius</i>).....(text)	633		
Gibraltar of the Rhine, Fortress of Ehrenbreit-			
stein.....	ill. 12		
"Gift of burning mountains," A Maori chief's			
Gifts, Cattle as, among the Latins.....	ill. 118		
Gifts, Farewell: Rapa Island.....	610		
Gig, Ship's, travels 1,300 miles for help.....	425		
Gila River Valley, Ariz.....	107-108		
232, 235			

	Page		Page
Ginseng Family (Dwarf Ginseng).....	71	Grecian Urn, immortalized by Keats.....	610
(color insert) Plate XIII, 46-71		Greece and Turkey Exchange Two Million of	
"Giraffe of Vegetables" (coconut palms).....(color		Their People. By Melville Chater.....	533
insert) Plate VII, 402-419		Greece, Government of.....	563-564, 582, 583
Girl feeding cattle over a wall.....	ill. 609	Greece, Revolution in.....	539
Girl tending geese: Rhine Valley.....	ill. 40	Greek ships, U. S. flags flying on.....	540, 559
Girls, Canoes handled by: Rapa Island.....	426	Greeks, Anatolian.....	533, 559
Girls, Turkish: Near East.....	(color insert)	ill. 534, 535, 563, 567, 580, 582, 588, 589	
Plates IV, V, 540-557		Greely Expedition, 1884.....	482, 503, 524
Glaciers: Arctic Regions.....	(text) 484, 505	Green Island, Hawaiian Group.....	107, 108
ill. 488, 523, 529		Green Tomb (Yeshil Turbeh): Turkey.....(text)	
Glaciers, Clouds and.....	163, 178, ill. 167	Plate IV, 540-557	
Gladstone, (William E.), Reference to.....	575	Green Turtle: Lisiansky Island, Hawaiian	
Glossy Buckthorn (<i>Rhamnus frangula</i> L.).....	45-46	Group.....	ill. 97
(color insert) Plate VI, 46-71		Greenland ice-cap, References to the.....	475
Goat census: Germany.....	(text) 19	510, 511, 515, 529, 532	
Goat girl: Germany.....	ill. 19	Greenland: MacMillan Arctic Expedition.....	478, 495
Goats, Gift of: Rapa Island.....	425	497, 502, 513-514, 515, ill. 483-485, 488, 490, 491	
Goats, Herd of: Switzerland.....	ill. 42	497, 498, 502, 503, 508, 510-512, 514, 516, 521-525	
Goats, Polynesian natives astounded by.....	373	529, 530	
Goats, Shepherd with his: New Mexico.....	ill. 319	Greenland Redpoll.....	475
Goatskin headdress, Oxen wearing: Pyrenees		Greenlanders, Natives called.....	ill. 483, 508, 510, 511
region.....	ill. 700	Greeting custom, Maori: New Zealand.....	ill. 126
Gobi Desert, Clouds and the.....	180	Grenfell, (Dr.) Wilfred: Labrador.....	(text) 478
"God, Possessor of the World": Arabic inscription		ill. 353, 476	
(text) Plate IV, 540-557		Grew, Joseph C. Waimangu and the Hot-spring	
Godhavn, Greenland.....	(text) 350, 497	Country of New Zealand.....	109
Godthaab Fiord, Greenland.....	515, ill. 512	Grinding songs, Indian.....	237
Godthaab, Greenland.....	514, 515, 516	Grinding stones, Indian: U. S. Southwest.....	234-235
Goethe (Johann Wolfgang von), References to.....	22	236, ill. 242	
23, 26, 34		Grosvenor, (Dr.) Gilbert: National Geographic So-	
Goff & Miller Co. (1783).....	634	ciety.....	360, 517, ill. 224, 476
Golden Guernseys (Cattle).....	ill. 606	Guadalupe Canyon, Tex.....	ill. 317
Golden Horn, Stamboul (color insert) Plate II, 540-557		Guadalupe Mountains, N. Mex.....	301, 317
Golden Horseshoe, Royal Opera House: Athens.....	ill. 573	Guano Bats.....	323, 328, 330, ill. 325, 327
Goldenclub (<i>Orontium aquaticum</i> L.).....	44	Guano industry: Carlsbad Cavern, N. Mex.....	301, 330
(color insert) Plate I, 46-71		Guano industry: Laysan Island.....	85, 86, 103
Gondola, Motor boat vies with the: Venice.....	196	Guano-producing bats.....	323, 324, 326, 328, 330
Gondolas of Constantinople.....	(color insert)	ill. 325, 327	
Plate II, 540-557		Guantanamo, Cuba, Reference to.....	462
Gondolier, Personality of the.....	196	Guard, Changing the: Tripoli.....	131-132, ill. 136
"Gooney" (Black-footed Albatross).....	(text) 82, 86	Guard, Governor's: Tripoli.....	(color insert)
Goose, Blue, Life history of the.....	350	Plate IV, 140-149	
Goose girl, Rhine Valley.....	ill. 40	Guard, Palace: Athens.....	ill. 574
Gooseberry Family (Wax Currant).....	71	Guava (plant): Marquesas.....	371
(color insert) Plate XIII, 46-71		Guernsey Cows.....	(color insert) Plate XIII, 638-679
Goosefoot Family (Lambs-quarters).....	71	Guernseys (Cattle).....	591, 617, 636, 676-677
(color insert) Plate XIV, 46-71		ill. 606, 607, 609, 685, 689	
Gothic architecture, Germany.....	7, ill. 8, 10, 11	<i>Guerrière</i> (English ship).....	(text) 428
Gothic flower, Cologne Cathedral a gorgeous.....	7	Gufah (circular boat), Constructing a: Bagdad.....	ill. 216
Gourd Family (Mock-cucumber).....	72	Guild House, Butchers': Germany.....	ill. 626
(color insert) Plate XIV, 46-71		Gulf of Bu Kemes.....	ill. 151
Gourd water-jar: Rapa Island.....	(color insert)	Gulf of Hiero, Island of Mitylene.....	(text) 563
Plate I, 402-419		Gulf of Kaloni, Island of Mitylene.....	(text) 563
Gourds, Ancient: Arizona.....	270	Gulf of St. Lawrence, Reference to the.....	493
Government, Pueblo peoples' form of self.....	237, 252	Gulf of Sidra, Reference to the.....	151
Governor's bodyguard: Tripoli.....	(color insert)	Gulf, Smyrna.....	ill. 565
Plate IV, 140-149		Gulf Stream, Reference to the.....	464
Grain profiteer, 10th century.....	17, 23	Gulls, Arctic.....	ill. 350
Grain, Threshing: Thrace.....	ill. 577	Gulls at sunset.....	ill. 172
Grand Banks of Newfoundland, Fogs and the.....	180	Gun, watchlock: Tibetan Kitchen.....	ill. 346
Grand Canal, Venice.....	196	Guns, Destroyer.....	ill. 437, 442, 459
Grand Canyon (Ariz.), An electrical storm over		Guppy, (Henry B.), Reference to.....	365
the.....	163, ill. 171	Gutenberg, Johann.....	20, 26, 28, 29, 35, 36
Grand Coulée, Steamboat Rock: Cattle.....	ill. 622	Gutenberg Monument: Frankfort-on-the-Main.....	26
Grand Hotel, Tripoli.....	131	ill. 29	
Grandmother and baby, Greek.....	ill. 567	Gutenberg statues: Europe.....	20, 35
Grape culture: Germany.....	ill. 18, 23-25	Gymnasium, Ship hawser used as a: South Sea	
Grapes of Damascus.....	(color insert)	Island boys.....	ill. 399
Plate XI, 540-557			
Grass country, Tibetan.....	346, 347		
Grass, Tax on: Tibet.....	347		
Grasshoppers, Pests of: Pueblo Bonito, N. Mex. 241			
Grating coconut meat: Austral Islands.....	(color		
insert) Plate VIII, 402-419			
Grave robbers, Bodies found, victims of: Pueblo			
Bonito, N. Mex.....	245, 274, 291, ill. 236, 237, 241		
Gray, Harold E.: MacMillan Arctic Expedition.....	482		
Grazing land, Cattle: India.....	ill. 617		
Great Britain, New breeds of cattle and.....	617		
Great Britain originated most of the world's best			
breeds (cattle).....	597		
Great Britain: Wild White Cattle.....	(color insert)		
Plate VI, 638-679			
Great Caribou, Labrador.....	ill. 478		
Great Hoary Bats (<i>Nycteris cinerea</i>).....	330		
Great Horned Owls.....	329, 330		
Great Ragweed (<i>Ambrosia trifida</i> L.).....	75		
(color insert) Plate XXII, 46-71			
Great Wairakei Geyser, New Zealand.....	ill. 114		
Great White Way, Island of Hikueru.....	386		

H

Hailstones: South Africa.....	ill. 178
Hair, Bats do not entangle themselves in the....	322
Hair, Cow's, used for brushes.....	592
Hairdresser, Hopi: Arizona.....	ill. 258
Hairdressing, Persian man's.....	ill. 219
Hairdressing, Slavic: Save River Basin.....	ill. 204
Hairdressing, Turkish mode of mourning.....	ill. 205
Hairy Ruellia (<i>Ruellia ciliosa</i> Pursh).....	44
(color insert) Plate I, 46-71	
Haka (war dance): New Zealand.....	ill. 128, ill. 129
Halibut fishermen, American: Greenland.....	514
Halifax: Nova Scotia.....	518
Hama, Syria.....	214
Hama (Syria), Melons from.....	(color insert)
Plate XI, 540-557	
Hamadan (Ecbatana), Persia.....	222
Hamilton, Dukes of. Seat of the.....	605
Hamilton Inlet, Labrador.....	486
Hammada el-Homra, Italian Libya.....	149

	Page		Page
Hammock, Baby's crib at: Macedonia.....	575	Iiikueru, Island of: Tuamotu Group.....	385, 386
Hammock, Sailor asleep in his: U. S. Navy destroyer.....	469	Hildebrand, J. R.: National Geographic Society.....	517
Hanurana Spring, New Zealand.....	119, 122	Himalaya Mountains, Clouds and the.....	163, 178
Hanalei, Kauai, Hawaiian Islands.....	107	Himalaya Mountains, Tibetan transport in the.....	618
Hanavave Valley, Fathuiva Island.....	377	HISTORY'S GREATEST TREK: TRAGEDY STALKS THROUGH THE NEAR EAST AS GREECE AND TURKEY EXCHANGE TWO MILLION OF THEIR PEOPLE. BY MELVILLE CHATER.....	533
Hanchow, China.....	337	Hivaoa Island, Pigeon peculiar to.....	(color insert)
"Hands, Burial of the".....	291-292		Plate XI, 402-419
Handy, (Dr.) E. S. C., References to.....	375, 383	Hoary Tickclover (<i>Desmodium canescens</i> DC.)....	74
Hanging Gardens of Babylon.....	220	(color insert) Plate XXI, 46-71	
Hannibal, Brusa (Turkey) was founded by.....	(text)	Hoe, Woman with the: Germany.....	13
	Plate VII, 540-557	Hogs, Polynesian.....	373, 394
Hannibal, Torch-bearing bullocks employed by....	614	Hohenzollern Bridge, Cologne, Germany.....	ill.
Hano Pueblo, Arizona: Tewa squaw.....	244	(aerial view).....	8
"Hans Sachs Town" (Rhens, Germany).....	14	Holland.....	2, 3, 21, ill. 703
Hansweert Canal, Holland.....	2, 3	Holmes, Oliver Wendell, Reference to.....	(text) 428
Haum, mistress of a Turkish home.....	(color insert) Plate VIII, 540-557	Holms Gerardia (<i>Agalinis holmiana</i> (Greene) Pennell).....	71, (color insert) Plate XI, 46-71
Harbor, Etah: Greenland.....	507, 510, 522	Holstein-Friesian (Cattle).....	591
Harbor, Pandora: Greenland.....	ill. 485	617, 636, 660-661, 664, ill. 631, 689	
Harbor, Payer: Ellesmere Island.....	503	Holstein-Friesian (Cattle).....	(color insert)
Harbor, World's largest river: Germany.....	6		Plate X, 638-679
Harvest scene, Clouds and a.....	ill. 173	Holstenborg, Greenland.....	513, ill. 503, 509, 510
Harvesting grain: Thrace.....	ill. 577	Holy banners, Negro festival and: Tripoli.....	ill. 153
Haslach, Germany.....	ill. 35	Home life: Near East.....	(color insert)
Hatitheu Bay, Nukuhiva Island.....	ill. 379		Plates I, IV, VIII, XII, 540-557
Hatteras, Cape, off North Carolina coast.....	463, 464	Homer: Quoted.....	(text) 367
Hatto, Bishop, Legend of the wicked.....	17, 19, 23	Homes, Refugee: Near East.....	559, 561
Hatutu Island, Marquesas.....	ill. 398	ill. 570, 572, 573, 583, 586, 587	
Hau Island, Tuamotu Archipelago.....	365	Homs, Syria.....	214
Hau tree: Laysan Island.....	103	Homs, Tripolitania.....	151, 160
Haut-Rhin, Department of (France).....	35	Honey Eater, Laysan (bird): Hawaiian Islands.....	85, 103
Hawaii Island, Hawaiian Group.....	(text) 79	Hong (greeting custom): New Zealand.....	ill. 126
Hawaiian Bird Reservation: Bird Life Among Lava Rock and Coral Sand. By Alexander Wetmore.....	77	Honolulu, Hawaiian Islands.....	77, 85, 104, 106, 108
Hawaiian Islands.....	360, 361, 371, 373, 375	Hop, Common (<i>Humulus lupulus</i> L.).....	74
Hawaiian Islands: Bird Life Among Lava Rock and Coral Sand. By Alexander Wetmore.....	77	(color insert) Plate XX, 46-71	
Hawaiian Islands: Map.....	79	Hopedale, Labrador.....	(text) 225
Hawaiian Islands, Rainfall in.....	178	350, 479, 486, 487, 493, 495, 516	
Hawaiian Monk Seal.....	104, 108	Hopi Indians.....	233, 243, 245, 251, 253
Hawaiian Rat.....	108	ill. 233, 243, 258, 259, 262, 264, 296	
Hawaiian Terns (birds): Laysan Island.....	ill. 100	Hopi village, Ariz.....	ill. 233
Hawks, Arctic.....	350	Horned Toads: New Mexico.....	317
Hawks (birds): South Sea Islands.....	(text) 360	Horns, Products made from.....	591, 592
Hawkweed, Orange (<i>Hieracium aurantiacum</i> L.)....	46	Horse, Cavalryman of Tripolitania with his.....	(color insert) Plate I, 140-149
(color insert) Plate VIII, 46-71			
Hawsters, as a gymnasium, Ship's: South Sea Island boys.....	ill. 399	Horse-drawn fire engine: Turkey.....	ill. 566
Hawthorn, Downy (<i>Crataegus mollis</i> (T. and G.) Scheele).....	45, (color insert) Plate III, 46-71	Horse-racing: New Zealand.....	129
Hay, Stacked.....	ill. 173	Horses, Polynesian natives astounded by.....	373
Hayes Fiord, Ellesmere Island.....	505, 526, 529	Horsetail Family (plant).....	72
Head of Buddha, Giant: China.....	ill. 339	(color insert) Plate XVI, 46-71	
Headress, Oxen wearing goatskin: Pyrenees region.....	ill. 700	Hospitality, South Sea Island.....	419, 424-425
Healing, God of (statue): Tripolitania.....	ill. 161	Hot-spring Country of New Zealand, Waimangu and the. By Joseph C. Grew.....	109
Heartleaf Umbrella-wort (<i>Allionia nycaginea</i> Michx.).....	71, (color insert) Plate XII, 46-71	Hot Spring Country, New Zealand: Map.....	113
Heat, Cloud material and.....	163, 167, 168, 171, 180	Hot-water creeks: New Zealand.....	(text) 123
Heath Family (flowers).....	72	Hotel, Pera Palace: Constantinople.....	207
(color insert) Plates XV, XVI, 46-71		Hotevilla Pueblo (Arizona): Terraced garden.....	ill. 260
"Heavenly Twins" (mudholes): New Zealand.....	119	House Bat (<i>Myotis incantus</i>).....	329
"Heaving the lead": U. S. Navy destroyer.....	ill. 436	House-building: Pueblo Bonito, N. Mex.....	247-248
Heeling a calf.....	ill. 598	ill. 234	
Hekau, or temples: Necker Island, Hawaiian Group.....	79, ill. 80	House, Erecting a Samoan: Island of Olosenga.....	ill. 391
Heidelberg Castle: Germany.....	ill. 31	House of the Butchers' Guild: Germany.....	ill. 626
Heidelberg, Germany.....	29, 30, 34	Housekeepers, Prehistoric: Pueblo Bonito, N. Mex.....	253, 256
Heidelberg tun (monster cask), Famous: Germany.....	(text) 31	Houses, Turkish: Constantinople....	(color insert)
Heidelberg University: Germany.....	29		Plate III, 540-557
Hell's gate (ledge of silica): New Zealand.....	ill. 116	Huapu Island, Marquesas.....	(color insert)
Heraldry: Zealand's swimming lion.....	3		Plate VII, 402-419
Herbert Island, Greenland....	(text) 497, 502, ill. 530	Hungarian Oxen.....	ill. 633
Herd exalted by ancient civilization.....	608	Hungarian plain cattle.....	ill. 696
Hereford, English (Cattle).....	ill. 599	Hupei dollars: China.....	347
Herefords (Cattle).....	591, 617, 627, 629, 630, 668-669	Hurricanes: Pacific Islands.....	366, 419
672, ill. 604, 680, 695		Hut, Cane: Tripolitania.....	ill. 157
Herefords (Cattle)....	(color insert) Plate XI, 638-679	Hydro-electric stations: Rhine River.....	39
Hermopolis, Island of Syria.....	581		
Hesiod, Greek poet: Quoted.....	346	Icarus and clouds.....	180
Hetso Gomba, China.....	346	Ice Ages, Reference to.....	163
Hetso Gomba monastery, China.....	346	Icebergs: Arctic Regions.....	507, 515, 519, 522, 527, 532
Highlanders, West (Cattle).....	(color insert)	ill. 348, 351, 480, 481	
	Plate XV, 638-679	Iceland, Reference to.....	5
Hibiscus trees: Pacific Islands.....	355	Idaho, Water power in.....	180
Hide masks, Hopi Indians make.....	ill. 259	Idol, Stone: Vavitaio Island.....	ill. 421
Hiero, Gulf of: Island of Mitylene.....	(text) 563	Idols, Stone: Necker Island.....	79
Highways, Clouds move along definite.....	177, 178, 180	Igloodahouny, Robertson Bay, Greenland.....	475, 504
		510, 529, 532, ill. 497, 498, 500, 502, 530	

Iles Dangeereuses, Les: Tuamotu Archipelago...
 (color insert) Plate V, 402-419
 Imbrie, (Maj.) Robert Whitney: Persia..... 222
 Immigration, Refugee: Greece..... 503
 "Imperator Caesar Augustus Lucius Septimius":
 Inscription..... 161
 Implements, Agricultural: Germany..... ill. 13, 18, 22
 Implements, Primitive..... 299
 Imports, Cattle: United States..... 634-635
 "In the South Seas" by Stevenson..... 357
 In-you-gee-to (Eskimo): Greenland..... 511, ill. 492
 "Index to the Islands of the Pacific" by Brigham..... 360
 India: Brahmans (Zebus)..... (color insert)
 Plate IV, 638-679
 India, East: Wild Ox..... (color insert)
 Plate I, 638-679
 India, England to: Map (automobile route)..... 193
 India: From England to India by Automobile. By
 Maj. F. A. C. Forbes-Leith..... 191
 India, Rainfall in..... 178, 179
 India: Scenes..... ill. 611, 613, 617
 India, Quetta: Fruit market..... ill. 223
 India: Water Buffalo..... (color insert)
 Plate V, 638-679
 Indian bulbuls (birds): South Sea Islands..... (text) 360
 Indian corn, greatest animal-fattening food..... 598
 Indian mythology, Names from: Carlsbad Cavern,
 N. Mex..... (text) 304, 305, 308-309, 310
 Indian Ocean, Reference to..... 178
 Indian Paintbrush (*Castilleja coccinea* (L.)
Spreng.)..... 71, (color insert) Plate XI, 46-71
 Indian pottery maker..... ill. 296
 Indian (Water) Buffalo (*Bos bubalus*)..... 641, 644
 Indiana State Flower (Tuliptree)..... 73
 (color insert) Plate XVIII, 46-71
 Indiana State Flower (Tuliptree)..... 73
 (color insert) Plate XV, 46-71
 Indians, Hopi..... ill. 264, 296
 Indians' Nooge, Carlsbad Cavern, N. Mex..... ill. 304
 Indians, North American: Everyday Life in
 Pueblo Bonito, New Mexico. By Neil M.
 Judd..... 227
 Indians, North American: Exploring in the Can-
 yon of Death (Cafon del Muerto, Arizona).
 By Earl H. Morris..... 263
 Industries: Germany..... 6, 10, 21, ill. 4, 5
 Ineboli, Asia Minor..... 559
 Infants, Destruction of new-born: Pacific Islands
 (text) 387
 Inferno (thermal region): New Zealand..... 119, ill. 116
 Inglefield Bay, Greenland..... 510, 511, 513
 Inn, French: Briere, France..... 193, ill. 194
 Insect life, Disappearance of: Lisiansky Island..... 104
 Insects, Bats consume great numbers of..... 321, 323
 326, 328
 Insects: Pacific Islands..... 373
 Inscription, Roman: "Imperator Caesar Augustus
 Lucius Septimius"..... 161
 Inter-marriage, Arab and Negro: Tripolitania..... 139
 International Cloud Atlas..... (text) 182
 International Grenfell Hospital, Forteau Bay..... 353
 Iraq (Mesopotamia), Crossing..... 215, 217-220
 ill. 190, 215-216
 IRIDESCENT ISLES OF THE SOUTH SEAS.
 (COLOR INSERT, XVI PLATES)..... 402-419
 Iron, Clouds and..... 163
 Iron mills: Germany..... 6
 Ironwood (tree): Hawaiian Islands..... 103, 106, ill. 100
 Irrigation: New Mexico—Arizona..... 232-233, 261
 ill. 260
 Irrigation, Origin of..... 232
 Irrigation wheel: China..... ill. 339
 Ishtar Gate, Babylon..... 220
 Isis, Cow sacred to: Egypt..... 610
 Island of Beyerland, Holland..... 3
 Island of Chios (Greece)..... 539, 581
 Island of Hikueru, Tuamotu Archipelago..... 385, 386
 Island of Malta, Reference to the..... 557
 Island of Mitylene (Lesbos), Ægean Sea..... 539, 593
 572, 574, 575
 Island of Syra (Greece), Refugee children on
 the..... ill. 581
 Isle of Fatuhiva, Marquesas..... ill. 368, 377
 Ispahian, Persia..... 222
 Israelites in an Arabic setting: Jews in Tripoli
 ill. 150
 Issus, Plain of: Turkey..... 211
 Italian-Austrian battle front..... 196-197
 Italian Colony, Modern: Tripolitania, Where Rome
 Resumes Sway. By Col. Gordon Casserly..... 131
 Italian flag: Africa..... 131, 132
 Italian Libya: Map..... 138
 Italian Libya (North Africa)..... (color insert)
 VIII plates, 140-149
 Italian population: Tripolitania..... 151
 Italy, Crossing (by automobile)..... 193-194, 196-198
 ill. 198-200, 202
 J
 J A (John Adair): Cattle company..... 629
 Jack-in-the-pulpit, Taro is similar to the..... 370
 Jack Lane Bay, Labrador..... (text) 482, 516
 Jack Rabbit Bat, or Jackass Bat..... ill. 328
 Jacobs, (Capt.) W. V. E.: *Thetis* (ship)..... 86
 Jacob's little trick upon Laban..... 613
 Japanese "ox cobbler"..... ill. 708
 Japanese poachers kill birds for feathers: Ha-
 waiian Islands..... 86
 Jaynes, John M.: MacMillan Arctic Expedition..... 507
 Jersey Cattle..... 591, 617, 636, 672-673, 676
 ill. 693, 698
 Jersey Cows..... (color insert)
 Plate XII, 638-679
 Jessamine, Carolina (*Gelsemium sempervirens* (L.)
Ait. f.)..... 72, (color insert) Plate XVI, 46, 71
 Jesus the Savior, Moslem who calls himself: China 346
 Jewelry, Bedouin woman's: Tripolitania..... (color
 insert) Plate VII, 140-149
 Jewish population: Tripolitania..... 151
 Jewish quarters: Tripolitania..... 137-138, 140
 ill. 150, 151
 Jewish women: Tripoli..... (color insert)
 Plate III, 140-149
 Johann II, Château of Prince: Liechtenstein..... 41
 John the Baptist, Descendant of..... ill. 215
 John's Glacier, Greenland..... ill. 488, 523
 Johnston Island, Hawaiian Group..... ill. 108
 Judd, Neil M. Everyday Life in Pueblo Bonito
 As Disclosed by the National Geographic So-
 ciety's Archeologic Explorations in Chaco Can-
 yon National Monument, New Mexico..... 227
 Judd, Neil M., Explorations of..... 300
 Jumna River, India..... ill. 611
 Jungle Ox, East Indian Gayal or..... 604
 K
 Kachina maker, Hopi..... ill. 243
 Kahoolawe Island, Hawaiian Group..... (text) 79
 Kaichow, China..... 341, 347
 Kaiserstrasse, Frankfurt-on-the-Main, Germany..... 22
 Kaloni, Gulf of: Island of Mitylene..... (text) 563
 Kane Basin, Greenland..... 503
 Kano, Anglo-Egyptian Sudan..... 151
 Kansu (Province), China..... 337, 341, 344, ill. 344
 Karagach bridge, Anatolia..... 557
 Karna (Eskimo village), Greenland..... (text) 504
 510, 511, 513
 Kasr Zafran (Sirte), Tripolitania..... 149
 Kauai Island, Hawaiian Group..... 77, 79, 107, 178
 Kauehi Island, Tuamotu Archipelago..... ill. 372, 400
 Kaukura Island: Tuamotu Group..... (color insert)
 Plate XV, 402-419
 Kayaks (hunting boats): Arctic Regions..... ill. 487
 511, 512
 Kayaks (canoes): Germany..... 10, 20, 26
 Keats, (John): Quoted..... 610
Keftiyah (handkerchief), Arab wearing a..... ill. 217
 Kehl, Germany..... 34
 Kemalist Government, Reference to the..... 205
 Kennedy, (Capt.) Miffin: Cattle owner..... 628
 Kerbey, McFall. Toilers of the Sky (Clouds)..... 163
 Kerries and Dexters (Cattle)..... 687-688, 693
 Keshish Dag (Asian Olympus): Turkey..... (color
 insert) Plate V, 540-557
 Khan Sheikhun, Syria..... 214
 Kharput, Asia Minor..... (text) 537
 Khorasan, Persia, Reference to..... (text) 218
 Kiangti, China..... 333
 Kiating, China..... 337, ill. 335, 339
 Kids, A Couple of: Sailor feeding a kid..... ill. 452
 King, Richard: Cattle owner..... 627-628, 629
 King, Tombstone of a: Rimitara Island..... ill. 421
 Kingfisher (bird): Pacific Islands..... 393
 Kingfisher, Marquesan..... (color insert)
 Plate XII, 402-419
 Kirmanshah, Persia..... 222
 Kissing custom, Gallic: Bulgaria..... 204
 Kitchen, Cows in the: Europe..... ill. 601
 Kitchen, Rich man's: China..... ill. 346

	Page		Page
Kitchens, Roof: Pueblo Bonito, N. Mex.....	253	Laysan Honey Eater (bird): Hawaiian Islands	85, 103
Kivas: Pueblo Bonito, N. Mex.....	248-249, 252 ill. 228, 230	Laysan Island, Hawaiian Group.....	77, 79 82, 84, 85-86, 87, 88, 92-95, 100, 101, 103, 104, 106 ill. 88, 92-95, 99-101
Klondike gold-rush, Reference to the.....	570	Laysan Rail (bird): Hawaiian Islands.....	103
Knife, Sheath, a protection against sharks.....	ill. 85	Laysan Teal (bird): Hawaiian Islands.....	103
Knights of Malta, References to.....	131, 132, 149	Le Puy, France: White Oxen.....	698
Knights of Saint John of Jerusalem.....	149	Leads (open water): Arctic Regions.....	503
Knitted caps, Greenlanders wearing.....	ill. 483	League of Nations, Near East and the.....	533, 540 564, 567, 580
Knud Peninsula, Ellesmere Island.....	526	League of Nations—Near East: History's Great- est Trek. By Melville Chater.....	533
Koelportstraete, Antwerp, Belgium.....	1	Leatherwing bats, Reference to.....	321
Koelz, (Dr.) Walter N.: MacMillan Arctic Ex- pedition.....	226, 349, 350, 475, 479, 514, 518 ill. 489, 499	Lebda (Roman Leptis Magna): Tripolitania.....	149 160-161, ill. 161
Kokikoko (gray warbler): Christmas Island.....	402	Lee, Willis T.: Carlsbad Cavern, N. Mex.....	ill. 305
Kolonibyster (Governor): Sukkertoppen, Green- land.....	514	Lee, Willis T. New Discoveries in Carlsbad Cavern (New Mexico): Vast Subterranean Cham- bers with Spectacular Decorations are Explored, Surveyed and Photographed.....	301
Konia (Turkey).....	210, 535, ill. 212	Leeward Islands, Hawaiian Group.....	77, 85, 86, 107
Konia (Turkey).....	(color insert) Plate VII, 540-557	Legend, Nihoa Island: Hawaiian Group.....	77
Koo Vanyu Loft, Treasures of: Carlsbad Cavern, N. Mex.....	309, ill. 310	Legends, German.....	1, 5, 7, 10-11, 15, 17, 19, 23, 29
Koo Vanyu (stone snakes), Carlsbad Cavern, N. Mex.....	309, ill. 310	Leicesters (Sheep).....	620
Kooloolies, descendants of Turks and Arabs.....	151	Lemon trees: Tahiti.....	394
Koran, Quotations from the.....	(text) Plates I, X, 540-557	Lepers: Rapa Island.....	426
Kornok, Greenland.....	ill. 512	Leptis Magna, Tripolitania: Roman ruins.....	149 160-161, ill. 161
Krusenstern, (Adam J. von), References to.....	358, 380	Lesbos (Mitylene), Island of: Ægean Sea.....	539, 563 572, 574, 575
Kum, Salt desert of: Persia.....	222	Liberty engines: <i>Bowdoin</i> (ship).....	495
Kutaia, Asia Minor.....	(text) Plate IV, 540-557	Libya, Italian: Map.....	331
Kweichow Province, China.....	331	Libya, Italian (North Africa).....	(color insert) VIII plates, 140-149
Kyloes (West Highland Cows).....	ill. 619	Libya, Italian Tripolitania, Where Rome Resumes Sway. By Col. Gordon Casserly.....	131
L			
La Farge, John, Reference to.....	357	Libyan Desert, Bedouin woman of the.....	(color insert) Plate VII, 140-149
La Gorce, John Oliver.....	ill. 352	Libyan Desert, Wandering sand hill of the.....	ill. 158
La Pérouse, References to.....	78, 358	Lichen-covered slabs, Prehistoric wall of: Rimitara Island.....	ill. 424
Labor, Farm: Yugoslavia.....	ill. 206	Lichen, Red: Arctic Regions.....	515
Labor, Indian: Pueblo Bonito (N. Mex.) Expe- dition.....	230, ill. 234	Liechtenstein, Principality of.....	40, 41
Labrador, MacMillan Arctic Expedition at.....	486	Life, Loss of: Burning of Smyrna (1922).....	540
493, 495, 516, ill. 348, 350, 351, 353, 473, 474, 476 478-480		Life, Loss of: Near Eastern exchange of popula- tions.....	584, 590
Labrang, China.....	343, 347, ill. 345	Light and water, Color hymn of.....	ill. 170
Labrang monastery, China.....	343, 347, ill. 345	Light, Spirit of (Love Tern in flight).....	ill. 87
Ladder, Carlsbad Cavern: New Mexico.....	ill. 307	Lighting system: Carlsbad Cavern, N. Mex.....	308
Lagoon Channel of Manihi, Tuamotu Archipelago ill. 376		Lightning over the Grand Canyon.....	ill. 171
Lagoon made by three canals: Strasbourg.....	34	Lilac, Common (<i>Syringa vulgaris</i> L.).....	73-74 (color insert) Plate XIX, 46-71
Lagoon of Kauchi, Tuamotu Archipelago.....	ill. 372	Lily-of-the-valley Family (Purple Trillium).....	72 (color insert) Plate XVII, 46-71
Lagoons: Hawaiian Islands.....	85, 86, 103, 104, 106	Limb of a tree, Bird egg on the.....	ill. 399
Lagoons, South Sea Island.....	363, 365, ill. 362, 376	Limestone: Carlsbad Cavern, N. Mex.....	311, 319
Lake, Alida: Greenland.....	ill. 488	Limousin (Cattle).....	657
Lake Chad, Africa.....	151	Lion column, Winged: Venice.....	ill. 199
Lake Constance, Switzerland.....	39, 40	Lion, Swimming: Heraldic device of Zealand (Province), Holland.....	3
Lake, Frozen: Ellesmere Island.....	475	"Lions," Fiume.....	197-198
Lake of Antioch, Asia Minor.....	211	Lisbon, Portugal: Bullfighting arena.....	ill. 707
Lake Rotomahana, New Zealand.....	115-116, ill. 110	Lisiansky Island, Hawaiian Group.....	79, 86, 103-104 ill. 97
Lake, Rotorua: New Zealand.....	119, 120	Lisiansky, Urey: Russian explorer.....	103
Lake Taupo, New Zealand.....	130	Little California Bat (<i>Myotis californicus</i>).....	330
Lakes, Hot: New Zealand.....	119	Littleton Island, Greenland.....	505
Lambs-quarters (<i>Chenopodium album</i> L.).....	71 (color insert) Plate XIV, 46-71	Liverpool (England), Cattle industry at.....	598
Lanai Island, Hawaiian Group.....	(text) 79	Living Buddha of Labrang, China.....	343, 345, 347
Landings, Boat: Hawaiian Islands.....	77, 103, 104 ill. 76, 81	Living costs: Germany.....	9, 26
Landmark, Historic: France.....	193, ill. 194	Livy, (Titus Livius), Reference to.....	614
Landseer, (Sir) Edwin, Cattle in the art of (text) 619		Lizards: Polynesia.....	373
Lane, Cattle winding down a.....	ill. 606	Llano Estacado of our old geographies.....	623
Langskov, Christian, Governor of Sukkertoppen, Greenland.....	514	Loading cattle: Peru.....	ill. 701
Language, Polynesian: Island of Rapa.....	(text) 381	Loan, Refugee Settlement: Greece-Turkey.....	579
Lantana (<i>L. Camara</i>).....	371	Lobith, Holland.....	5
Lanterns, Cave lighted with: Carlsbad Cavern, N. Mex.....	302, 304, 308	Locks, Canal: Holland.....	2, 3
Large Brown Bats (<i>Eptesicus fuscus</i>).....	329, ill. 325	Locomotive's whistle supplants Lorelei's song.....	15
Large Pale Bats (<i>Antrozous pallidus</i>).....	329	Loening Amphibian planes: Arctic Regions.....	478, 519 ill. 521-523, 525, 526, 528, 530
Lariat, Swinging a: U. S. West.....	ill. 624	Log, Zufi (Indian) boys carrying a great: Pueblo Bonito, N. Mex.....	234
"Last of Five Thousand" (animal painting) by Russell.....	630	Logania Family (Carolina-Jessamine).....	72 (color insert) Plate XVI, 46-71
Laufen Castle: Switzerland.....	ill. 38	Logging industry: Germany.....	21
Laundrywomen, Rhine riverside.....	39	Lohengrin's monument at Cleve, Germany.....	5
Lausanne Treaty.....	564, 572	Loire, Valley of the: France.....	193
Law, Protective (ancient) for the herds.....	612, 614	Lokiang, China.....	337
Lawson, W. E., Cattle owned by.....	ill. 689	Lombardy, Plains of: Italy.....	194
Laysan Albatrosses: Hawaiian Islands.....	108, ill. 80, 90, 91, 96, 102, 105	"London," Christmas Island.....	402
Laysan Finches: Hawaiian Islands.....	85, 103, 106		

	Page		Page
Lone Star State (Texas).....	627	Manhattan Island, Reference to.....	176
Long-eared Bats (<i>Corynorhinus rafinesquii</i>) <i>palle-</i> <i>scens</i>).....	328, ill.	Manihiki Island, Tuamotu Group.....	ill. 376, 399, 422
Longhorn, Texas (Cattle).....	(color insert)	Manihiki Islands (Monahiki).....	360
Longhorns (Cattle).....	Plate XX, 638-679	Manufactures: Basel, Switzerland.....	39
	620, 627, 629, 630	Maori characteristics: New Zealand.....	127, 128
	ill. 705, 708-709, 710	Maori tribespeople: New Zealand.....	ill. 125-130
Look, Miriam, Reference to.....	513	Maori village, New Zealand.....	122, 127, ill. 117
Lorelei Broadcasting Company: Station LORE.....	15, 17	Map: Arctic Regions. Supplement, November, 1925	
Lorelei (Lurlei), Dwelling place of the.....	15, ill. 17	Map: Carlsbad Cavern, N. Mex. (sketch).....	302
Los Cerrillos, N. Mex.....	247	Map: China (sketch).....	334
Loti, Pierre, Reference to.....	358	Map: England to India, automobile route.....	193
Lotus, American (<i>Nelumbo lutea</i> Willd. Pers.).....	75	Map: Hawaiian Islands.....	79
	(color insert) Plate XXIV, 46-71	Map: Italian Libya.....	138
Love Birds: Nihoa Island.....	78	Map: New Mexico (sketch).....	232
Love Terns (birds), Laysan Island.....	87, 93, 94	Map: Rotorua Hot Spring region, New Zealand.....	113
"Lucia," Chinese listening to a phonograph play- ing.....	ill. 344	Map: Tahiti (relief).....	362
Lütien, China.....	331	Map: Vavai, Austral Group.....	369
Lynnhaven Roads, Va.....	462	Maps: Polynesian Archipelagoes.....	358, 366
Lyon, France, Reference to.....	193	Marble, Onyx: Carlsbad Cavern, N. Mex.....	309
			312, 314
M			
McCormick Bay, Greenland.....	511	Marchand, (Étienne), References to.....	358, 380
McDonald, E. F., jr.: MacMillan Arctic Expedi- tion.....	482, 500	Maria Island, Tuamotu Group.....	394
McGee, Paul J.: MacMillan Arctic Expedition.....	482	Maritza River (Europe), Near Eastern refugees and the.....	540, 557, ill. 586
McKitterick Cave, N. Mex.: Bats.....	328	Markers, String: Carlsbad Cavern, N. Mex.....	304
MacMillan Arctic Expedition.....	ill. 224-226	Market, Fruit: India.....	ill. 223
MacMillan Arctic Expedition: Flying Over the Arctic. By Lieut. Commander Richard E. Byrd.....	519	Market, Medicine: China.....	337
MACMILLAN ARCTIC EXPEDITION RE- TURNS: U. S. NAVY PLANES MAKE FIRST SERIES OF OVERLAND FLIGHTS IN THE ARCTIC AND NATIONAL GEO- GRAPHIC SOCIETY STAFF OBTAINS VALUABLE DATA AND SPECIMENS FOR SCIENTIFIC STUDY. BY DONALD B. MACMILLAN.....	477	Market, Outdoor: France.....	ill. 196
MACMILLAN ARCTIC EXPEDITION SAILS, THE.....	225	Market, Outdoor: Germany.....	ill. 28
MacMillan Arctic Expedition, Scientific Aspects of the.....	349	Market scene, Damascus.....	ill. 213
MacMillan, Donald B.....	226, 475, 477	Markets, Outdoor: Tripolitania.....	ill. 154, 158
	ill. 224, 352, 476	Marne River, France.....	(text) 32, 34
MacMillan, Donald B.: MacMillan Arctic Expe- dition.....	522, 525, 527, 529, 532, ill. 487, 496	Maro Reef, Hawaiian Group.....	(text) 79, 82
MacMillan, Donald B. The MacMillan Arctic Expedition.....	477	Marquesan Fruit Pigeon.....	(color insert)
MACMILLAN IN THE FIELD.....	473	Marquesan Kingfisher (bird).....	Plate XI, 402-419
Macedonia, References to.....	564, 576, 579, ill. 587		(color insert)
Machi, Mohammedan General of Sining, China.....	343	Marquesan natives.....	380, 382-383, ill. 377, 388, 389
	346, 347	Marquesas Islands.....	355, 360, 361, 363, 366, 370, 373
Madder Family (Bluets).....	72-73	Marquesas Islands.....	375, 380, 385, 388, ill. 368, 377, 388, 389, 397, 398
	(color insert) Plate XVII, 46-71	Marquesas Islands: Scenes.....	(color insert)
Madrid, Spain: Bullfight.....	ill. 706	Marquesas Islands: Maps.....	Plates II, III, VI, VII, 402-419
Magnetic poles, Reference to the.....	523	Marquesas Islands: Map.....	ill. 258
Magnetism, Earth's.....	523	Marriage customs, Indian: U. S. Southwest.....	248, 249
Magnolia Family (Tulip tree).....	73		ill. 258
	(color insert) Plate XVIII, 46-71	Marriage customs, Maori (tattooing): New Zea- land.....	129
Mahuta, King of the Maoris: New Zealand.....	ill. 127	Marriage customs: Marquesas Islands.....	382
Maid of Athens Street, Athens.....	590	Marseille, France, References to.....	34, 194
Mail delivery: Black Forest region, Germany.....	ill. 34	Mascot, Cat: England to India Automobile Ex- pedition.....	191, 192-193, 211, 214
Mail from home: Sailors on shipboard.....	ill. 464	Mascots, Sailors with their.....	ill. 452, 454, 455
Mail service: Syrian Desert.....	214, 219	Mason, (Capt.) John, Cattle imported by.....	633
Main, River: Germany.....	21, 29, ill. 30	Masonry, Pueblo Bonito: New Mexico.....	(text) 238
Mainz, Germany.....	15, 20, 26, 35, 36, ill. 28		258, 260, ill. 228
Makatea Island: Pacific Ocean.....	ill. 390	Masons, Polynesian: Tureia Island.....	ill. 390
Makemo Island, Tuamotu Group.....	ill. 422	Massacre Cave, Arizona.....	263, ill. 265
Maketu, New Zealand.....	ill. 125	Matador (cattle company).....	629
Makronisi Island, Greece.....	563, ill. 576	Matagorda Bay, Tex.....	(color insert)
Malaria, Refugees suffered with: Asia Minor.....	575, 579	Mating season, Bats.....	ill. 323
Malay Peninsula: Wild Ox.....	(color insert)	Mau Island, Hawaiian Group.....	(text) 79
	Plate II, 638-679	Maximus, Fabius, in the Punic Wars.....	614
Malaysia, Reference to.....	373	Maypop (<i>Passiflora incarnata</i> L.).....	74
Male refugees: Near East.....	539, ill. 558, 562		(color insert) Plate XXI, 46-71
Malta, Island of, Reference to.....	557	Me-tik (Eskimo): Greenland.....	ill. 495
Maltese population: Tripolitania.....	151	Meadowbeauty Family (Common Meadowbeauty) (color insert) Plate XVII, 46-71	73
Mammals: Bats of Carlsbad Cavern, New Mexico. By Vernon Bailey.....	321	Meal, Grinding: Indian millers.....	234-235, ill. 242
Mammals, Land: Polynesia.....	373	Mealtime on board a destroyer: "Chow".....	ill. 448
Man harnesses the clouds.....	177, 180	Meat packer, First American: William Pynchon	633-634
Man-of-war Birds: Pacific Islands.....	402, ill. 83, 364		ill. 495
	394, 395, 397	Meats, Preserved, for the Entente Allies.....	598, 600
Manchester cotton prints: Pacific Islands.....	ill. 386	Mecca (Arabia), Caravans from: Damascus.....	214
Manchuria, Buffalo caravan in.....	ill. 616	Mecca, Sign showing distances to: Tripolitania.....	ill. 159
Mangareva Island, Tuamotu Group.....	419, ill. 374, 425	Medallion, Arabic: Turkey.....	(text)
Mangrove trees: Pacific Islands.....	369		Plate IV, 540-557
		Medicine market: China.....	337
		Medieval castle, Europe's best preserved: Schloss Eltz.....	ill. 16
		Medieval Castle of Rheinstein: Germany.....	ill. 26
		Meditation, Bird in (Love Tern).....	ill. 93
		Mejdlerich, Germany.....	6
		Meissen, Heinrich von: German poet.....	20, 28
		Melanesian isles, Forests of.....	373
		Melkon, (Onnig): MacMillan Arctic Expedition.....	518
		Melon Cactus (<i>Echinocactus horizonthalonius</i>) (color insert) Plate IX, 274-291	
		Melons: Turkey.....	(color insert)
			Plates IX, XI, 540-557

	Page
Melville Bay, Greenland.....	482, 500, ill. 486, 506
Melville, Herman, References to.....	355, 357, 373
Memorial, Christian: Rimitara Island.....	421
Memorial Tablet, National Geographic Society's:	
Greenland	503
Men employed in industries: Germany.....	6, 10
Meudoza, viceroy of New Spain.....	623
Mental strain, Carlsbad Cavern workers under a.....	302
Menstone, France	193, ill. 197
Mephistopheles of Goethe's "Faust".....	23
Meredith, George, Reference to.....	11
Meshed, Persia, Reference to.....	211
Metal worker: Damascus.....	ill. 214
Metates (grinding stones), Indians using.....	234-235
	ill. 242
Meteorological work	352-354
Meteorology: Clouds.....	ill. 162, 164-166, 168-177
	179, 181-188
Meteorology: Clouds, Toilers of the Sky. By	
McFall Kerbey	163
Meuse River, France.....	(text) 32, 34
Mevlana Jalal ed-din Rumi, Tomb of: Asia Minor	210
Mevlevi sect of dervishes: Asia Minor.....	210, ill. 212
Mexican free-tailed Bats (<i>Tadarida mexicana</i>)...	323
Mice: Polynesia	373
Midway Islands, Hawaiian Group.....	77, 79, 86, 104, 107
Mienchow, China	337, 341, 347
Milch cow, German master and.....	ill. 601
Military ceremonies: Tripoli.....	131-132, ill. 136
Milk as a food.....	ill. 592
Milk, Coconut: Pacific Islands.....	393, 424
Milk delivery cart: Scotland.....	ill. 698
Milk, Manufactured articles from.....	596
Milk River, Mont.....	ill. 625
Milkers, Deep (cattle).....	606, 608, 616, 629
Milking machine, Electric: Washington, D. C.....	ill. 628
Milking a Buffalo.....	ill. 613
Milkweed Family (Fourleaf Milkweed).....	73
	(color insert) Plate XIX, 46-71
Milkwort Family (Fringed Polygala).....	73
	(color insert) Plate XVIII, 46-71
Mill, Camel-driven: Tripolitania.....	137
Miler, (Dr.) Loyer.....	(text) 99
Miller, G. S. List of mammals.....	321
Millerbird: Hawaiian Islands.....	(text) 76, 78, 85, 103
Millers, Indian: New Mexico.....	ill. 242
Mills, Stone, used by the Indians.....	234-235, ill. 242
Mimosa Family (Sensitiveplant).....	74
	(color insert) Plate XIX, 46-71
Min River, China.....	(text) 339, ill. 340
Mina (<i>Acridotheres tristis</i>) (bird).....	(text) 360
	371, 389, 394
Minaret, Distant: Tripolitania.....	ill. 133
Minarets of Brusa (Turkey).....	(color insert)
	Plate V, 540-557
Minbar (mosque pulpit): Tripoli.....	140
Minchow, China	341, 343, 347
Mine-sweeper class, Ship of the: U. S. S. <i>Tanager</i>	
.....	77, ill. 78
Miner, Edward Herbert. Illustrator.....	(cattle
paintings) (color insert) XX plates, 638-679	
Mineral water, Hot: New Zealand.....	ill. 117
Mines, Turquoise: New Mexico.....	247
Minnesingers, Reference to the.....	20
Minor Dutch Types (Cattle).....	664
Minstrel, Wandering: Tripolitania.....	ill. 155
Mirror Lake (pool), Carlsbad Cavern, N. Mex.....	309
Misda, Tripolitania	149
Mission, British: Society Islands.....	384
Mission, Moravian: Labrador.....	493
Missionaries, Bandits capture (Mr. Willistan and	
family): China	337
Missionaries: Pacific Islands.....	383, 384, 387
Missolonghi Square, Athens.....	590
Missouri State Flower: Downy Hawthorn.....	45
	(color insert) Plate III, 46-71
Mists, Clouds are.....	163, 177
Mitylene, Island of (Lesbos): Ægean Sea.....	539, 563
	572, 574, 575
"Moby Dick" (book), by Herman Melville.....	357
Mock-cucumber (<i>Echinocystis lobata</i> T. and G.)...	72
	(color insert) Plate XIV, 46-71
Modesty, Symbol of (headgear): Turkey.....	(color
insert) Plate V, 540-557	
Mohammed II, Sultan of Turkey.....	(text)
	Plate II, 540-557
Mohammed VI, Sultan of Turkey.....	557
Mohammedan priest: Tripoli.....	(color insert)
	Plate VI, 140-149
Mohammedan robbers: China.....	341
Mohammedan sect called the New Sect: China.....	346
Mohammedan washing custom: Constantinople.....	ill. 211
Mokkovik, Labrador	493
Molasses-candy, Pulling: China.....	ill. 335
Molasses, Rauti root.....	424-425
Molecules, Vapor.....	167, 168, 170, 171, 174,
Molecules, Water.....	163, 167, 174, 175-176, 180
Moller (Island), Laysan Island formerly known	
as	85
Mollusks, Land: Tahiti Island.....	363
Molokai Island, Hawaiian Group.....	(text) 79
Monastery for Dervishes: Turkey.....	(color insert)
	Plate XII, 540-557
Monastery, Hetso Gomba: China.....	346
Monastery, Labrang: China.....	343, 347, ill. 345
Monastery, Radja Gomba: China.....	343, 346
Money, Roman word for (from <i>pecus</i> , cattle)...	612
Money unknown among the Ngoloks (Tibet).....	347
Monfalcone, Italy	196-197
Mongols, Reference to.....	377
Monhegan Island, Maine coast.....	518
Monsoon (wind), Track of the.....	178
Montana, Cattle in.....	ill. 594, 625
Monte Carlo, Monaco.....	193
Monument, Allenby: Asia Minor.....	211
Monument, European War: Tahiti.....	ill. 361
Monument, Gutenberg, (Johann): Germany.....	ill. 29
Monument Valley, Utah-Arizona border.....	(color
insert) Plates II, VI, 274-291	
"Mooleys" or "muleys," Hornless calves known	
as	(text) 604
"Moonlight Sonata," Beethoven's.....	9
Morrea, Society Islands.....	358, 373, ill. 385
Moravian Brothers of Newwed.....	11
Moravian settlements: Labrador.....	486, 493, 516
Mormon immigrants: Utah.....	629
Morrell (Island), Old maps showed.....	107
Morris, Earl H. Exploring in the Canyon of	
Death (Arizona): Remains of a People Who	
Dwelt in Our Southwest at least 4,000 Years	
Ago Are Revealed.....	263
Morris, (Mrs.) Earl H.....	ill. 297, 299
Mosaic ornaments, Indian: Arizona.....	272-273, 291
	ill. 273
Moselle, Department of (France).....	35
Moselle River, Germany.....	ill. 16, 37
Moslem custom (first-born son).....	(color insert)
	Plate I, 540-557
Moslem who calls himself Jesus the Savior	
(China)	346
Moslems, Exchange of Christians and: History's	
Greatest Trek. By Melville Chater.....	533
Mosque, Dervishes in the yard of the: Asia Minor	
ill. 212	
Mosque, Negro: Tripoli.....	140, 152, 153
Mosque of a Tekkeh: Turkey.....	(color insert)
	Plate XII, 540-557
Mosque of Dragut: Tripoli.....	(text) 133
Mosque, 16th century: Turkey.....	ill. 209
Mosques of Brusa (Turkey).....	(color insert)
	Plate V, 540-557
Mosquitoes: Pacific Islands.....	373
Mother and baby, Eskimo.....	ill. 501
Mother and baby, Greek: Macedonian refugees	
ill. 575	
Mothers and babies, Indian: Zufi Pueblo, N.	
Mex.	ill. 249
Motor boat vies with the gondola in Venice.....	196
Motzaping, China	337
Mt. Demavend, Persia.....	(text) 218
Mt. Fujiyama, Japan.....	ill. 179
Mt. Pagos, Turkey.....	533, 539
Mt. Tamalpais (Calif.), Sunset from.....	ill. 177
Mt. Tarawera, New Zealand.....	109, 110, 116, 130
	ill. 111
Mt. Waialeale, Kauai (Hawaiian Islands).....	178
Mountain, Orohena: Tahiti Island.....	363, 396
Mountains, Clouds and.....	163, ill. 165, 166, 177, 179
Mountains, Elburz: Persia.....	ill. (distant view) 218
Mountains, Guadalupe: New Mexico.....	301, 317
Mountains, New Mexico.....	301, 316-317
Mountains, Taurus: Turkey.....	211
Mourning custom, Turkish: Yugoslavia.....	ill. 205
Mouse Tower, Rhine River.....	17, 19, ill. 23, 25
Mouth organ, Eskimo child playing a: Greenland	
ill. 489	
Moving picture, Bird dance in a: Laysan Island	
ill. 105	
Moving pictures: MacMillan Arctic Expedition	
ill. 509	

	Page		Page
Moving pictures: South Sea Islands.....	386, 419	Navajo Indians, Land of the...(color insert)	
Mud volcano: New Zealand.....	ill. 123	Navajo's wolf god, War Club of the: Carlsbad	
Mudholes, Boiling: New Zealand.....	119, ill. 115, 116	Cavern, N. Mex.....	305
Mühlheim, Germany.....	36	Naval Aviation Unit, MacMillan Arctic Expedi-	
Mummies, Indian: Arizona.....	264, 272, 274, 291	tion.....	519, 527
	ill. 293, 297-299	Naval Museum: Annapolis, Md.....	108
Mummy-apple tree: Nukuhiva Island.....(text)	379	Navigation, Rhine River.....	37, 39
Mummy Cave, Ariz.....	264, 266, 272, 274	Navigator's compass.....	523
	ill. 268-271, 294	Navigators, Polynesian.....	358, 373
Murad II, Tomb of: Brusa, Turkey.....(color		Neanderthal skull: Bonn Museum.....	9
insert) Plate VI, 540-557		Near East Relief.....	572
Murchison Sound, Greenland.....	ill. 504	Nebuchadnezzar, King of Babylon.....	220
Murphy, Robert Cushman. The Romance of Sci-		Neckar (River): Germany.....	29
ence in Polynesia: An Account of Five Years of		Necker Island, Hawaiian Group...(text)	78, 79, 81
Cruising Among the South Sea Islands.....	355		ill. 80
Murray, (Sir) John, Reference to.....	365	Necker, Jacques: Swiss banker.....	78
Museum, Bonn: Germany.....	9	Necklace, Turquoise: Pueblo Bonito, N. Mex....	227
Music room: Carlsbad Cavern, N. Mex.....	ill. 309		229, 246, ill. 239
Musical instrument: Drum, Tripolitania.....	ill. 155	Necklace, Turquoise.....(color insert)	
Musical instruments: Flutes, Prehistoric.....	292, 293		Plate IV, 274-291
Musical instruments: Tripolitania.....	132, ill. 153, 155	Nectar Fountain, Carlsbad Cavern, N. Mex.....	315
Musicians, Child: Italy.....	ill. 198		316, ill. 310
Mussolini, (Benito), Reference to.....	194	Negro Colony: Tripoli.....	139-140, ill. 152, 153
Mythology, Cattle in.....	608, 610	Negro Mosque: Tripoli.....	140, 152, 153
Mythology, Indian: Carlsbad Cavern, N. Mex.		Negro population: Tripolitania.....	151
(text) 304, 305, 308-309, 310		Nest, Red-footed Booby on the.....	ill. 92
		Nest sticks, Frigate Bird stealing.....	ill. 88
N		Nest, Teal's (bird): Rapa Island...(color insert)	
N4-1 (airplane): MacMillan Arctic Expedition..	475		Plate XVI, 402-419
	502, 507, 510, 521, 529, 532, ill. 530	Nests, Bats have no.....	322
N4-2 (airplane): MacMillan Arctic Expedition..	475	Nests, Birds': Hawaiian Bird Reservation.....	ill. 88, 89
	502, 507, 522, 528, 529, 532, ill. 522, 523		92, 94, 99, 104
N4-3 (airplane): MacMillan Arctic Expedition..	475	Nests, Tropical birds and their.....	ill. 364, 394, 398
	502, 507, 522, 528, 531, 532		401, 426
Nahe (River), Germany.....	ill. 24, 25	Net, Fish caught in a: Hawaiian Islands.....	ill. 85
Nalut, Tripolitania.....	149	Nets, Fishing for salmon with: Germany.....	ill. 21
Name, Indian, for Pueblo Bonito, N. Mex.....	260	Nettle Family (Common Hop).....	74
Names, Animal: Polynesia.....	373, 375		(color insert) Plate XX, 46-71
Nempeyo, Indian potter: Tewa squaw, Arizona		Neuhausen, Switzerland.....	39
	ill. 244	Neuwied, Germany.....	11
Nansen, (Fridtjof), Reference to.....	478	NEW DISCOVERIES IN CARLSBAD CAV-	
Nantucket Shoals, Atlantic Ocean.....	441, 447, 448, 449	ERN (NEW MEXICO): VAST SUBTERRA-	
Napoleon (Bonaparte), References to.....	193, 194	NEAN CHAMBERS WITH SPECTACULAR	
Narghiles (water pipes), Arabs smoking: Bagdad		DECORATIONS ARE EXPLORED. SUR-	
	ill. 217	VEYED, AND PHOTOGRAPHED. BY	
Narvaez's Florida colony.....	623	WILLIS T. LEE.....	301
Narwhal and tusk: Greenland.....(text)	530, ill. 500	New Guinea, British: Cattle.....	ill. 695
Nashi tribespeople: China.....	311, ill. 332	New Hampshire State Flower (Common Lilac).....	73-74
National Geographic Magazine: Greenland.....	ill. 498, 510		(color insert) Plate XIX, 46-71
National Geographic Society: MacMillan Arctic		New Mexico: Scenes.....	ill. 228-231, 234-241, 249, 252
Expedition.....	473		253, 255-257, 303-315, 318-320, (color insert)
National Geographic Society: MacMillan Arctic			Plates V, IX, XII, XVI, 274-291
Expedition Sails.....	225	New Mexico: Bats of Carlsbad Cavern. By Ver-	
National Geographic Society: New Discoveries in		non Bailey.....	321
Carlsbad Cavern. By Willis T. Lee.....	301	New Mexico, Carlsbad Cavern: Map.....(sketch)	302
National Geographic Society: Scientific Aspects of		New Mexico: Carlsbad Cavern, New Discoveries	
the MacMillan Arctic Expedition.....	349	in. By Willis T. Lee.....	301
National Geographic Society Staff Obtains Valu-		New Mexico: Everyday Life in Pueblo Bonito.	
able Data and Specimens for Scientific Study:		By Neil M. Judd.....	227
The MacMillan Arctic Expedition Returns. By		New Mexico: Map.....(sketch)	232
Donald B. MacMillan.....	477	New Street, Bagdad.....	218, 219
National Geographic Society's Expedition camp,		New Year's Festival: Island of Bali.....	ill. 697
Pueblo Bonito, N. Mex.....	ill. 229	New York City (1882).....	231
National Geographic Society's Expedition camp:		New York City's water supply.....	176-177
Texas State Park.....	ill. 317	New Zealand.....	360, 361, 375, 381 ill. 110-112
National Geographic Society's Expedition camp:			114-118, 120-130
Carlsbad Cavern, N. Mex.....	301	New Zealand, Hot Spring region of: Map.....	113
National Geographic Society's Expedition to Pueblo		New Zealand, Waimangu and the Hot-spring	
Bonito (New Mexico). By Neil M. Judd.....	227	Country of. By Joseph C. Grew.....	109
National Geographic Society's Photographic Ex-		Newfoundland, Grand Banks of.....	180
pedition in Arizona.....	ill. 265	Newspaper Cooperation: MacMillan Arctic Ex-	
National Monument, Carlsbad Cavern (New Mex-		pedition.....	482
ico). By Willis T. Lee.....	301	Ngauruhoe Volcano, New Zealand.....	ill. 118
National Monument, Chaco Canyon (New Mex-		Ngauawahia, New Zealand: Canoe race.....	ill. 128
ico): Everyday Life in Pueblo Bonito. By		Ngoloks (tribespeople): Tibet.....	346, 347
Neil M. Judd.....	227	Nibelungen hoard, References to the.....	15, 29, 39
National monument, German Empire.....	ill. (distant view) 24	"Nibelungenlied," References to the.....	5, 6, 29
National Park Service, U. S.....	308	Nice, France.....	193, ill. 195, 196
National Park, Tongariro: New Zealand.....	ill. 118	Niederwald (mountain-ridge), Germany.....	ill. 24, 25
"Native Culture in the Marquesas" (book) by		Nigerian Railway.....	151
Dr. E. S. C. Handy.....	383	Nihoa Finch (bird): Nihoa Island.....(text)	76, 77-78
Natural Bridge, Rainbow: Utah.....(color insert)		Nihoa Island, Hawaiian Group.....	77-78, 79, 81, ill. 76
	Plate III, 274-291	Niuhau Island, Hawaiian Group.....(text)	79
Naturalist in the Arctic.....	350-351	Nimbus clouds.....	189, ill. 176
Nature's laboratory.....	163	Niobrara (River), Nebraska.....	630
Navajo Indians: U. S. Southwest.....	233, 238, 243, 245	Nivernais (Cattle).....	657
	246, 263, 265, 293, 300. ill. 267	Niza, Fray Marcos de: Missionary.....	247
		Nold, (Andrew C.): MacMillan Arctic Expedi-	
		tion.....	531, 532

Ornaments, Turquoise.....(color insert)
Plate IV, 274-291

Orohena (Mont): Society Islands.....363, 396

Orphanage, Syrian, Girl metal worker in an.....ill. 214

Owens, (Mr.): Canyon of Death, Ariz.....291

.....ill. 294, 299

Owls, Great Horned.....329, 330

Ox at the yoke.....610

"Ox cobbler," Japanese.....ill. 708

Ox pulling a mired automobile, An: Chosen.....ill. 694

Ox teams: Europe.....ill. 632, 633, 634, 700, 702

Ox, Stone, over Meat Hall entrance: Germany.....ill. 626

Oxcarts, Anatolian.....ill. 536

Oxen, Sacred, of India (Brahmans).....ill. 691

Oxen, Threshing grain with: Thrace.....ill. 577

Oxen, White: France.....ill. 698

Oxen, Wild.....(color insert) Plates I-III, 638-679

Oxhorns bring good luck: Moslem superstition.....ill. 570

P

Pacemaker for the camel, Ass the: Near East
(color insert) Plate XIII, 540-557

Pacific Islands: Iridescent Isles of the South
Seas.....(color insert) XVI plates, 402-419

Pacific Islands: Maps.....358, 366

Pacific Islands: Polynesia, The Romance of
Science in. By Robert Cushman Murphy.....355

Pacific Islands: Scenes.....(color insert)
XVI plates, 402-419

Pack ice: Arctic Regions.....ill. 486, 506

Packing-house industry: United States.....591, 598, 600

Padua, Italy, Reference to.....194

Pagan sacrifices: South Sea Islands.....358

PAGES FROM THE FLORAL LIFE OF
AMERICA (WILD FLOWERS).....44

Pagos, Mount: Turkey.....533, 539

Pai Tak Pass, Persia.....220

Pails, Vender of: Fiume.....ill. 202

Paint, Faces protected against desert heat with:
Pueblo Bonito, N. Mex.....239

Paintbrush, Indian (*Castilleja coccinea* (L.)
Spreng.).....71, (color insert) Plate XI, 46-71

Painted house fronts: Europe.....14, 39, ill. 41

Painting, "Plowing in the Nivernais" by Rosa
Bonheur.....ill. 696

Painting, "Young Bull" by Paul Potter.....ill. 699

Paintings, Prehistoric bison: Spain.....ill. 682

Paintings, Prehistoric rock: Arizona.....ill. 292

Palace: Athens, Greece.....ill. 569, 571

Palestine, Christian women of.....(color insert)
Plates XIV, XV, XVI, 540-557

Pali (cliff): Hawaiian Islands.....77

Palm fronds for house walls, Braiding: Pacific
Islands.....ill. 376

Palm trees called the "Giraffe of Vegetables"
(color insert) Plate VII, 402-419

Palm trees: Pacific Islands.....77, 103, ill. 360, 372
374, 379, 390-392, 400, 695

Palm trees: Pacific Islands.....(color insert)
Plates III, VI, VII, 402-419

Palm trees: Tripolitania.....ill. 136, 154, 156, 158

"Pals": Sailor with a cat.....ill. 452

Pampas cattle, Crossbred: Argentina.....ill. 600

Panama Canal, Reference to the.....451

Pandanus trees: Polynesia.....369

Pandora (ship).....(text) 485

Pandora Harbor, Greenland.....ill. 485

Papiengai (hamlet), China.....333

Pantshen Lama of Tashi Lunkpo.....343

Papago Indians.....253

Papeete, Tahiti.....389, 419, 425, ill. 359, 361

Parakeets, Brush-tongued: Polynesia.....(color
insert) Plate XIII, 402-419

Paris, France, References to.....34, 192, 193

Paradshin, Yugoslavia.....ill. 203

Park Cattle: Great Britain.....(color insert)
Plate VI, 638-679

Park Cattle, Wild White or.....645

Parrot venders, Mexican.....247

Parsley Family (Common Carrot).....74
(color insert) Plate XX, 46-71

Parthenon (Athens), References to the.....564, 590

Parthian kings, Reference to.....220

Partridge Pea (*Chamaecrista fasciculata* (Michx.)
Greene).....75, (color insert) Plate XXIII, 46-71

Party, A sweetmeat: Near East.....(color insert)
Plate XIII, 540-557

Pass, Beilan: Svria.....257

	Page		Page
Pass, Dragoman: Bulgaria.....	201	Pier, Jette Promenade, Nice, France.....	ill. 195
Pass, Oberalp, Switzerland.....	43	Pier, Railroad: Smyrna.....	ill. 558, 560
Pass, Pai Tak: Persia.....	220	Pig iron produced in Ruhr district.....	6
Pass, Yakoutang: China.....	334	Pig to market, Carrying a: China.....	ill. 335
Passionflower Family (Maypop).....	74	Pigeon house: MacMillan Arctic Expedition.....	519
	(color insert) Plate XXI, 46-71		ill. 522, 524
Paths, Grazing cows have created a network of:		Pigeon, Tuamotuan purple-crowned fruit.....	ill. 396
India.....	617	Pigeons, Carrier: MacMillan Arctic Expedition.....	519-520, 522, ill. 524
Patras, Greece.....	(text) 568	Pigeons, Fruit: South Sea Islands.....	(color insert)
Patrocinio (Island), Old maps showed.....	107		Plates X, XI, 402-419
Patrol, Baluchistan Camel Corps.....	(text) 221	Pigs: Pacific Islands.....	373, 393, 394
Payer Harbor, Ellesmere Island.....	503	Piki (corn cakes), Indian woman baking: New Mexico.....	ill. 250
Pea Family (Hoary Tickclover).....	74	Pikow, China.....	337, 341, 347
	(color insert) Plate XXI, 46-71	Pim Island, Arctic Regions.....	505
Pea, Partridge (<i>Chamaecrista fasciculata</i> (Michx.) Greene).....	75, (color insert) Plate XXIII, 46-71	Pima Indians.....	253
Peaches, Drying: Arizona.....	ill. 264, 267	"Pineal substance" in cattle.....	596
Peacock Throne: Persia.....	222	Pinesap, Red (<i>Hypophitys insignata</i> Bicknell).....	72
Peaked Hill Bar gas buoy, (Mass.).....	436, 441		(color insert) Plate XV, 46-71
Pearl and Hermes Reef, Hawaiian Group.....	79	Pink Terraces, New Zealand.....	ill. 109, 110
	104, 108	Pinnacles, Rock: Arizona.....	(color insert)
Pearl divers: Hikueru, Island of.....	385-386		Plate VI, 274-291
Pearl Everlasting (<i>Anaphalis margaritacea</i> (L.) Benth. and Hook.).....	44-45, (color insert)	Pipe, Stone, Indian.....	292
	Plate II, 46-71	Pipes, Water (narghiles), Arabs smoking.....	ill. 217
Pearls, Cave: Carlsbad Cavern, N. Mex.....	315-316	Piræus, Port of Athens.....	(text) 566
	ill. 313	Pirates, Barbary.....	(text) 133
Peary (ship): MacMillan Arctic Expedition.....	349, 350	Pirates, Bird: Hawaiian Bird Reservation.....	ill. 83, 88
351, 353, 482, 486, 487, 493, 495, 497, 498, 499, 500			89, 104
505, 507, 511, 513, 514, 518, 519, 527, 529, 531, 532		Pirates, Tripoli was a famous haunt of.....	149
ill. 225, 226, 352, 479, 480, 489		Pisolites (cave pearls): Carlsbad Cavern, N. Mex.....	315-316, ill. 313
492, 493, 506, 521, 523		Pit homes: Tripolitania.....	159-160, ill. 160
Peary, (Adm. R. E.), References to.....	478, 482, 484	Pitcairn Island, Pacific Ocean.....	384, 388, ill. 392
497, 500, 503, 511, 519, 523, 524, 525, 530		Place of Darkness, Carlsbad Cavern, N. Mex.....	ill. 394
Peasant, Anatolian, one of Nature's gentlemen.....	209	Place-of-the-braced-up-cliff: Pueblo Bonito, N. Mex.....	260, ill. 235
Peasants, Persian.....	222, ill. 220	Plague, Longhorns (Cattle) were immune to.....	629, 630
Pecos (Pueblo village), N. Mex.....	245	Plains, Desert: New Mexico.....	316-317
"Peelin' Spuds": Sailors peeling potatoes.....	ill. 449	Plant zones: Tahiti Island.....	363
Peg-legged cow, A.....	ill. 620	Plantain Family (Plants).....	74-75
Peking Pike, Manchuria.....	ill. 616		(color insert) Plate XXII, 46-71
Pekmez, Syrup of the grape makes: Turkey.....	(text) Plate XI, 540-557	Plants, Desert, furnish edible seeds.....	231
Pellerano, Luigi. Illustrator. Under Italian Lib-ya's Burning Sun. (Autochromes Lumière).....	(color insert) VIII plates, 140-149	Plaster, Mud: Pueblo Bonito.....	ill. 238
	(color insert) VIII plates, 140-149	Platform, Ceremonial dance: Tahiti.....	396
Pendant, Turquoise, Mosaic: Arizona.....	272-273, ill. 373	Playground of the Desert Gods.....	(color insert)
Penguins on coral atolls.....	357		Plate II, 274-291
Peninsular, Bache: Ellesmere Island.....	503, 507, 524	Plaza de Toros, Madrid: Bullfight.....	ill. 706
Peninsula, Redcliffe: Greenland.....	511	Plovers, Golden (birds): Tahiti.....	393
Pennsylvania, Cattle industry in.....	634, ill. 688	Plow, American: Syria.....	214
"People of the Veil" (Berbers from Murzuk).....	(color insert) Plate II, 140-149	"Plowing in the Nivernais," painting by Rosa Bonheur.....	ill. 696
Pera (Constantinople).....	557	Plowing with Buffaloes: Dutch East Indies.....	ill. 612
Pera Palace Hotel, Constantinople.....	207	Plumes, Birds killed for: Hawaiian Islands.....	86
Perkeo (court jester), Statue of: Germany.....	ill. 31	Poachers, Feather: Hawaiian Islands.....	86
Persepolis (ruins), Persia.....	222	Podolian Cattle.....	641
Persia, Crossing (by automobile).....	220-222	Poi, or canoe, dance: New Zealand.....	ill. 125
	ill. 218-221	Poipoi (food), Polynesian staff of life.....	(text) 356
Persia resembles Switzerland.....	220		380, 381, 424, 425
Persia, Threshing with oxen.....	ill. 709	Poised for theft (Frigate Bird).....	ill. 88
Persian Desert, Crossing the: Automobile.....	222	Poisonous plants: Pacific Islands.....	371
	ill. 220, 221	Polar bear, Reference to.....	500
Personnel: England to India Automobile Expe-dition.....	191	Polar regions, Arctic: Map.....	Supplement
Personnel: MacMillan Arctic Expedition.....	349, 479		November, 1925
Personnel, Navy: MacMillan Arctic Expedition.....	349	Polar regions, Water vapor region over.....	168
Peru, Desert coasts of.....	180	Polar Sea, Mystery of the.....	477-478, 479, 509
Peru: Loading Cattle.....	ill. 701		521, 523, 527
Pests, Plant: South Sea Islands.....	371	Police, Desert: Iraq (Mesopotamia).....	ill. 190
Petrels (birds): Pacific Islands.....	81, 103, 108, 359, 402	Policeman, Syrian.....	214
Pets, Indians had many: Pueblo Bonito, N. Mex.....	241	Polled Herefords (Cattle).....	672, ill. 604
Pets, Sailors with their: U. S. Navy destroyers.....	ill. 452, 454, 455	Polled Shorthorns (Cattle).....	652, 704
	ill. 346	Polygala, Fringed (<i>Polygala paucifolia</i> Willd.).....	73
Pewter vessels: Tibetan kitchen.....	ill. 346		(color insert) Plate XVIII, 46-71
Philadelphia (American frigate), Destruction of the.....	(text) 133	Polynesia, The Romance of Science in. By Robert Cushman Murphy.....	355
Philadelphia became a cattle market.....	634	Polynesian Archipelagoes: Maps.....	358, 366
Phœnicians of Sidon, References to the.....	(text) 134	Polynesian colonies, Ruins of: Hawaiian Islands.....	77
	137, 149, 161	"Polynesian Researches" by William Ellis.....	355
Phoenix Islands, Pacific Ocean.....	360	Polynesians, References to native.....	375, 377, 380
Phonograph, Chinese listening to a: South Kansu.....	ill. 344		383, 384, 394, ill. 359, 390
Phosphate beds: Pacific Islands.....	ill. 390	Polynesians, Types of.....	(color insert)
Photographing in Persia under an armed guard.....	222		Plates I, VI, VIII, IX, XIV-XVI, 402-419
Photographs, Colored: MacMillan Arctic Expe-dition.....	349-350	Pommel, Saddle: Cavalryman of Tripolitania.....	(color insert) Plate I, 140-149
Photography, Color: Arctic Regions.....	514-515	Pondweed Family (plants).....	75
Photography, Motion-picture: Arctic Regions.....	ill. 489		(color insert) Plate XXII, 46-71
Piccadilly Circus, London.....	191, ill. (aerial view) 192	Pools, Carlsbad Cavern: New Mexico.....	308-309
Pictograph Cave, Ariz.....	293, ill. 292	Popoia Islands, Rat colony on: Hawaiian Group.....	108
		Population: Bagdad.....	217

	Page
Population, Bird, reckoned by acreage: Kauehi Island.....	ill. 400
Population: Hikueru, Island of.....	386
Population: Tripolitania.....	151
Populations, Exchange of: Greece and Turkey. By Melville Chater.....	533
Porridge Pot (boiling mudhole): New Zealand.....	119
	ill. 115
Porter, (David), References to.....	358, 380
Portières, Marble: Carlsbad Cavern, N. Mex. 312-313, ill. 307	
Portugal: Scenes.....	ill. 702, 707
Postal service: Germany.....	ill. 34
Potato, Sweet, Cultivation of the: Hawaiian Islands.....	77
Potatoes, Girls planting: Germany.....	ill. 7
Potatoes, Peeling: On board a destroyer.....	ill. 449
Potter, Paul, "Young Bull" (painting) by.....	ill. 699
Potter's wheel is an old-world invention.....	240
Pottery, Indian: New Mexico. 239-240, ill. 237, 242, 244, 248	
Pottery maker, Indian.....	ill. 296
Poultry, Polynesian navigators and.....	373
Pottery store: Nice, France.....	ill. 196
Power, Paradox of: Clouds and sea waves.....	ill. 175
Power, Sources of.....	177, 179, 180
Power, Water: Rhine River.....	39
Prairie dogs: New Mexico.....	317
Prehistoric Bonitians, New Mexico.....	231, 233, 245
Prehistoric cattle: British Isles..... (text)	690
Prehistoric cliff villages: Arizona.....	ill. 268-271
Prehistoric drawings: Bison.....	ill. 682
Prehistoric wall, Lichen-covered: Rimitara Island.....	ill. 424
Presents, Eskimo's: Greenland.....	ill. 498
President Roads, Boston outer harbor.....	427, 430
Press associations, MacMillan Arctic Expedition and the.....	482
Pretoria, South Africa: Hailstones.....	ill. 178
Price current meter.....	354
Prickly Pear (flowers)..... (color insert)	
	Plates XI, XV, 274-291
Priest, Mohammedan: Tripoli..... (color insert)	
	Plate VI, 140-149
"Priest's Water" (hot spring): New Zealand.....	119
Prince of Choni, a Tibetan chief.....	343, ill. 342
Printing press, Gutenberg's.....	20, 26, 35
Printing, Reputed father of: Johann Gutenberg.....	20
	26, 28, 29, 35
Prison, Heidelberg University: Germany.....	30, 34
Prisoners, Greek: Turkish Republic.....	ill. 558, 562
Products, Cattle.....	591, 592, 596
Promenade des Anglais: Nice, France.....	ill. 195
	(distant view)
Promenade, Scheldt-side: Antwerp, Belgium.....	1
Promenade, Sea: Tripoli.....	ill. 133
Propeller, Bowdoin (ship).....	495, 497
Prophet, Color associated with the: Turkey.....	(text) Plate IV, 540-557
Proverb, Dutch.....	3
Provincetown Museum, Specimen for the.....	500
Provisioning the world: Cattle.....	598
Pryor, Ike, Texas cattleman.....	629
Pueblo Bonito, (New Mexico).....	ill. 228-231, 234-241
	252, 253, 255, (color insert) Plate V, 274-291
Pueblo Bonito, (New Mexico), Everyday Life in. By Neil M. Judd.....	227
Pulpit, Mosque (minbar): Tripolitania.....	ill. 140
Pumpkin market: Turkey..... (color insert)	
	Plate IX, 540-557
Punaruu River, Tahiti.....	389, 396
Punic Wars, Reference to the.....	614
Purple-crowned Fruit Pigeon, Tuamotuan.....	ill. 396
Purple Sandpiper.....	475
Purple Trillium (<i>Trillium erectum</i> L.).....	72
	(color insert) Plate XVII, 46-71
Pychon, William, first American (meat) packer.....	633-634
Pyrenees Mountains region, Ox team in the.....	ill. 700
Pyxie (<i>Pyxidanthra barbulata</i> Michx.).....	46
	(color insert) Plate IX, 46-71
Q	
Quadruplets, Calif.....	ill. 689
Quai des Etats Unis, Nice, France.....	ill. 195
Quakers, Cattle industry and the.....	634
Quarantine Station, American: Makronisi Island.....	563, ill. 576
Quayle, Ernest H., References to.....	388, 398
Quays: Europe.....	1, 11
Queen, N. Mex., Scene near.....	ill. 318
Queensland, Australia: Cattle.....	ill. 599
Quetta, India.....	223, ill. 223
Quinine, Refugees dosed with: Macedonia.....	579
Quiros (Pedro F. de), References to.....	358, 380
R	
Rabbits, Gift of: Rapa Island.....	425
Rabbits, Pest of: Hawaiian Islands.....	86
	94, 95, 100, 101, 103-104
Race, Sacred cows': Island of Bali.....	ill. 697
Races, Carnival: New Zealand.....	129, ill. 124, 128
"Rachel" bath (hot spring): New Zealand.....	119
Racial types: Polynesia.....	375, 377, 380
Racing, Canoe: New Zealand.....	ill. 128
Racing, Yacht: New Zealand.....	ill. 124
Radio aërials on board ship.....	447-448
Radio broadcasting: Arctic Regions.....	ill. 482, 492
Radio: MacMillan Arctic Expedition.....	475-476
	482, 520, 527, ill. 491, 492
Radio Station, Battle Harbor, Labrador.....	(distant view) 478
Radio, Visible: Flag signals.....	ill. 467
Radja Gomba, China.....	343, 346
Radja Gomba monastery, China.....	343, 346
Rags, Shrine window tied with: Asia Minor.....	ill. 210
Ragweed Family (plants).....	75
	(color insert) Plate XXII, 46-71
Railroad, Central: Germany..... (text)	8
Railroad, Nigerian.....	151
Railroad Pier: Smyrna.....	ill. 558, 560
Railroad Stations, German.....	27, 29
Railroads, Italian: Tripolitania.....	151, 157
Rails (birds): Hawaiian Islands.....	85, 103, 106
"Rain, An Epic of": Thrace.....	557
Rain belt, World's.....	179
Rain, Clouds and.....	163, 167, 168, 170, 174, 176, 189
Rainbow most beautiful of cloud forms.....	189
Rainbow Natural Bridge, Utah..... (color insert)	
	Plates III, VII, 274-291
Raindrops, Sizes and speeds of.....	174-175, 178
Rainfall, Distribution of.....	178-179
Rainfall: Polynesia.....	366
Rainfall, World's daily (estimated)..... (text)	162
Rakes, Women with: Germany.....	ill. 18, 22
Rameses II, King of Egypt..... (text)	621
Ranches, Cattle: U. S. West. 627, 628-629, 630, ill. 594	
Rangitoto Channel, New Zealand.....	ill. 124
Rapa Island, Austral Group.....	388, 419, 424-426
	ill. 346, 370, 380-383, 420
Rapa Island, Austral Group..... (color insert)	
	Plates I, IV, IX, XVI, 402-419
Rapa Island, Pigeon peculiar to..... (color insert)	
	Plate X, 402-419

	Page		Page
REDISCOVERING THE RHINE: A TRIP BY BARGE FROM THE SEA TO THE HEAD- WATERS OF EUROPE'S STORIED STREAM. BY MELVILLE CHATER.....	1	Road, Buildings destroyed to make: Bagdad.....	218
Redknap, Montague: England to India Auto- mobile Expedition.....	191, 221	Road Construction: Asia Minor.....	206
Reef-forming coral islands.....	361, 363	Road, Manchurian: Peking Pike.....	616
Reefs, Hawaiian Group.....	(text) 79	Roads, Italians build fine: Tripolitania.....	151, 157
	82, 103, 104, 107, 108	Rob Roy canoes: New Zealand.....	119
Reefs, Tahiti.....	363, ill. 362	Robbers, Grave.....	274, 291
Refrigeration, Methods of.....	598	Robbers, Mohammedan: China.....	341
Refugee Settlement Commission: Near East.....	570	Robertson Bay, Greenland.....	475, 497, 502, 510, 511, 530
	574, 576, 579, 584	Robinson, Ralph P.: MacMillan Arctic Expedi- tion.....	507, 511
Refugees, Near Eastern.....	534	Rocheville, (Charles F.): MacMillan Arctic Expedi- tion.....	507, 522, 531
Refugees, Near Eastern: History's Greatest Trek. By Melville Chater.....	533	Rock Fingers (rock formations): Arizona.....	(color insert) Plate VI, 274-291
Refugees, Russian royalist: Constantinople.....	206	Rock, Joseph F., and the Prince of Choni.....	342
Reid Glacier, Ellesmere Island.....	505	Rock, Joseph F. Experiences of a Lone Geog- rapher: An American Agricultural Explorer Makes His Way Through Brigand-infested Cen- tral China en Route to the Amne Machin Range, Tibet.....	331
Reinartz, John L.: MacMillan Arctic Expedition.....	482	Rock paintings, Prehistoric: Arizona.....	292
	ill. 491	Rock Pigeons (birds): South Sea Islands.....	(text) 360
Relics, Polynesian colony: Hawaiian Islands.....	77	Rocks, Coast: Hawaiian Islands.....	76, 80, 81, 93, 94
Relics, Prehistoric Indian: U. S. Southwest.....	264, 270	Rocks of the Lorelei: Germany.....	17
272, ill. 236, 237, 239, 252, 255, 273, 294, 295, 297-300		Rocks, Sediment made.....	163
Religious ceremonies: Indians of the Southwest.....	248-249, 252, ill. 243, 255	Rodosto, Turkey.....	540, 557, 582, ill. 584
Religious ceremonies: Tripoli's negro colony.....	140	Roland, Legendary character of.....	10
	ill. 152, 153	Rolandseck, Germany.....	10
Religious ceremonies, Trumpets used in: China, ill.	345	Roman Catholic Church: Makemo Island.....	422
Religious organization, Recent: The New Sect (China).....	346	Roman legions camped on the site of Cologne, Germany.....	9
Religious rites, Cattle in.....	610	Roman occupation: Germany.....	9, 11, 22
Rennet, Curdling ferment known as.....	596	Roman ruins: Tripolitania.....	149, 160-161, ill. 135, 161
Reports, Radio: MacMillan Arctic Expedition.....	527-529, 531	ROMANCE OF SCIENCE IN POLYNESIA. THE: AN ACCOUNT OF FIVE YEARS OF CRUISING AMONG THE SOUTH SEA ISLANDS. BY ROBERT CUSHMAN MURPHY.....	355
Reptiles: Polynesia.....	373	Romans were students of breeding art (cattle)....	675
Reservation, Bird (Hawaiian Islands): Bird Life Among Lava Rock and Coral Sand. By Alex- ander Wetmore.....	77	Rome Resumes Sway, Tripolitania Where. By Col. Gordon Casserly.....	131
Rest, Hour of: Turkey (color insert) Plate IV, 540-557		Römergang, Cologne's underground tunnel known as.....	9
Revolution, American, and the cattle industry....	634	Roof, Party on the: Near East.....	(color insert) Plate XIII, 540-557
Reynolds brothers, Texas cattlemen.....	629	Rookery, Carlsbad Cavern, N. Mex.....	315-316, ill. 313
Rheinfels, Legend of.....	15	Roosevelt (ship), Reference to.....	524
"Rheingold," Legend of the.....	15	Roosevelt, Theodore, Reference to.....	77
Rheinhausen, Germany.....	6	Rope coil, Making the: U. S. Navy destroyer.....	ill. 465
Rheinstein, Castle of: Germany.....	ill. 26	Rosebay Rhododendron (<i>Rhododendron maximum</i> L.).....	72, (color insert) Plate XVI, 46-71
Rhens, "the Hans Wachs town".....	14	Rosegentian (<i>Sabatia angularis</i> (L.) Pursh).....	71
Rheumatism: Arctic Regions.....	(text) 495		(color insert) Plate XII, 46-71
Rhine occupation by American troops.....	I, 11, 12	Rosendahl, Governor of Godhavn (Disko Island)....	498
Rhine Promenade: Coblenz, Germany.....	14	Roses, Cultivation of: Bulgaria.....	201
Rhine (River), Rediscovering the. By Melville Chater.....	1	Rotomahana, Lake: New Zealand.....	115-116, ill. 110
Rhine River: Scenes.....	ill. 2	Rotorua Hot Spring region, New Zealand: Map....	113
	3, 8, 12, 14, 15, 17, 21, 23-27, 36, 38	Rotorua, New Zealand.....	109
Rhine Valley.....	ill. 7, 13, 18, 23-27, 40		113, 114, 115, 117, 119, 130, ill. 116
Rhododendron, Rosebay (<i>Rhododendron maximum</i> L.).....	72, (color insert) Plate XVI, 46-71	Rotorua Lake, New Zealand.....	119, 129
Rhône River, France.....	(text) 32, 34, 43	Rotterdam (Holland).....	(text) 2, 3, 37
Rhône, Valley of the: France.....	193	Rouen Cathedral: France.....	(text) 32
Ribbon manufacture: Basel, Switzerland.....	39	Rouge, Bonitian girls used: Pueblo Bonito, N. Mex.....	238
Rice field: Dutch East Indies.....	ill. 612	Rougier, Père, References to.....	(text) 364, 388
Rice Strait, Ellesmere Island.....	505	Rowboat, Tanager Scientific Expedition.....	ill. 76, 81
Richthofen Range, Kansu, China.....	347	Rowboats, Rhine River.....	ill. 23, 33, 38
Rigg, (Lieut.) Benjamin H.: MacMillan Arctic Expedition.....	226, 349, 354, 479, 513, ill. 350, 490	Royalist-refugee tragedy, Constantinople.....	206-207
<i>Rijn-Schelde</i> (steam barge), Rhine River.....	1	Ruellia, Hair (Ruellia ciliosa Pursh).....	44
	2, 3, 6, 9, 14, 21, 26, 36, ill. 2, 3		(color insert) Plate I, 46-71
Rile, Meister Gerhard von: Architect, Cologne Cathedral.....	7	Rug design, Copying a: Greek refugee.....	ill. 585
Rimitara Island, Austral Group.....	ill. 371, 421, 424	Rug, Handmade woolen: Yugoslavia.....	ill. 203
(color insert) Plates VIII, XIV, 402-419		Rugels Plantain (<i>Plantago rugelii Decne.</i>).....	74-75
Rio de Janeiro, Brazil, Oxen of.....	ill. 691		(color insert) Plate XXII, 46-71
River craft, Inflated cattle skins used as: India.....	ill. 615	Rugs, Weaving: Greek refugees.....	564, 584, ill. 585
River, Gila: Arizona.....	232, 235	Ruhr district, Germany.....	6, ill. 4
River harbor, World's largest.....	6	Ruhrort, Germany.....	6
River, Jumna: India.....	ill. 611	Ruins, Castle: Germany.....	ill. 23, 27, 31
River, Maritza (Europe), Near Eastern refugees and the.....	540, 557, ill. 586	Ruins, Norse: Greenland.....	475, 515, ill. 516
River, Milk: Montana.....	ill. 625	Ruins of Babylon, Reference to.....	220
River, Punaruu: Tahiti.....	389, 396	Ruins, Prehistoric: Arizona.....	264
River, Rhine: Rediscovering the Rhine. By Mel- ville Chater.....	1	Ruins, Rhine, in legend.....	10-11
River, Salt: Arizona.....	232	Ruins, Roman: Tripolitania.....	149, 160-161, ill. 135, 161
River, World's greatest: Amazon River.....	179	Rumeli Hissar, Port of: Bosphorus Strait.....	(color insert) Plate II, 540-557
Rivers: China.....	337, 339, 343, 346, 347, ill. 336, 340	Runways, Airplane: Arctic Regions.....	502, 519
Rivers, Clouds and.....	177, 180		ill. 522, 523
Rivers: France.....	(text) 32, 34, 43	Rurutu Island, Austral Group.....	ill. 367, 387
Rivers: Germany.....	11, 16, 20, 29, 37	Rush Family (Common Woodrush).....	75
ill. 2, 3, 8, 12, 14, 15, 17, 21, 23-27, 30, 36, 38			(color insert) Plate XXIII, 46-71
Rivers: New Zealand.....	(text) 128	Russell, "Charlie," animal painter.....	630

	S	Page	Page
St. Alexander Nevski Cathedral, Sofia, Bulgaria			162
ill. (aërial view)		208	164, 168, 170, 172, 175, 176
St. Kilda (Hebrides Islands): Fog		180	133
St. Patrick's Day celebration: New Zealand..(text)		128	373
St. Paul, Birthplace of: Asia Minor		211	Sea tales, Where made: Sailors writing letters
St. Raphael, France, Reference to		193	home
Saadi, Persian poet..(text) Plate VIII, 540-557		149, 161	Sea, Tasman, Reference to the..(text)
Sabrata, Tripolitania		518	Seal, Hawaiian monk
Sealsbraten, suburb of Frankfort, Germany		30	Seal hunting: Arctic Regions
(text)		604, 610, ill. 691, 697	Seal Island, Nova Scotia
Sacred cattle		539	Sealskin, Uses of: Arctic Regions
Sacrifice, Bull for: Egyptian carving		539	ill. 501 502, 511, 512, 514
Sacrifice to Victory: Smyrna		539	Seamanship, A touch of
Saddle, Cavalryman's: Tripolitania..(color insert)		539	Scaplane and destroyer
Plate I, 140-149		539	Seeds, plant, carried by birds
Saddles, Tuareg: Tripolitania..(color insert)		539	Seeds thousands of years old: Arizona
Plate II, 140-149		539	Seine River, France
Sagebrush country, Cattle in the: Wintertime		595	Selim II, Sultan, Mosque of: Adrianople
Sahara Desert, Clouds and the		180	Selimiye barracks for refugees: Near East
Sahara, French		149	ill. 587
Sailing ships at sea		176	210
Sala-y-Gomez Island: Pacific Ocean		361	Seljuk dynasty, Turkey
Saladin, Tomb of: Syria		214	Seminary on wheels, A: German women in a
Salamanders: South Sea Islands		373	farm wagon
Salaverry, Peru: Loading cattle		701	Senna Family (Partridge Pea)
Salmon fishing: Germany		20, 21	(color insert) Plate XXIII, 46-71
Salmon (Richard), MacMillan Arctic Expedition		498, 518	Sensitiveplant (<i>Mimosa pudica</i> L.)
Saloniki (Greece) 540, 563, 568, 570, 572, 575		587	(color insert) Plate XIX, 46-71
590, ill. 578, 582, 587		220	Senussi (sect): Africa
Salt area: Persia		163	Seraglio Point, Galata quay opposite: Constantinople
Salt, Clouds and the		222	(color insert) Plate VI, 540-557
Salt desert of Kum, Persia		232	Serbs, Croats and Slovenes, Kingdom of the
Salt River Valley, Ariz.		360	ill. 203
Samoa Islands, Pacific Ocean		361, 373, 375, 383, 385, ill. 391	Serbs, References to the
Samsun (Turkey) 534, 559, 568, 572		326	Sesuvium (grass): Laysan Island
San Antonio, Tex.: Bat cave		229, ill. 229	Seti I, Temple of (carving): Egypt
San Juan County, N. Mex.		632	"Seven Cities of Cibola," References to the famed
San Marino: Draft oxen		205	254, 623
Sancta Sophia, Constantinople		272	Severus, Septimius, Emperor of Rome
Sanctuary, Cave: Arizona		157	Sèvres Treaty
Sand dunes, Controlling: Tripolitania		158	Sewing, Eskimos: Arctic Regions
Sand hill, Wandering: Libyan Desert		106	Sewing machine, Sailors using a
Sand Island, Hawaiian Group		256	Sewing, Sailors: U. S. Navy destroyer
Sand, Rocks weathered by wind and		238	Sex adornment, Bird with strange: Frigate Bird
Sandals, Indian: Pueblo Bonito, N. Mex.		708	Sextant, Observing with a: On board a destroyer
Sandals, Oxen wear: Japan		270	Seydlitz, (Prussian general)
Sandals, Prehistoric Indian: Arizona		272, 291, 293, ill. 300	"Shaitan" or "Satan," Cat mascot called: Syria
Sanders, Alvin Howard. The Taurine World: Cattle and Their Place in the Human Scheme		591	Shark fishing: Pacific Ocean
Sanders, (Col.) Lewis, of Kentucky		634	Sharks, Swimmers wear sheath knives as protection against: Laysan Island
Sanitarium, Rotorua: New Zealand		117, 119	Shearwaters (birds): Hawaiian Islands
Santa Fe, N. Mex.		247	103, 107, 108
Santa Fe trail: U. S. West		629	Shearwaters (birds): Pacific Islands
Santa Gertrudis Ranch (Texas)		628, 629	Sheitan Akindisi (Satan's Stream): Bosphorus
Santa Maria della Salute, Church of: Venice		199	Strait
Santo Domingo, Indians of		247	(color insert) Plate II, 540-557
Sashes, Soldiers wearing: Tripolitania..(color insert) Plate V, 140-149		220	Shell-decorated canoe: Samoa
Sassanian architecture, Example of		220	Shell ornaments: American Indians
Satan's Stream (Bosphorus Strait)..(color insert) Plate II, 540-557		273, 274, 291, 292, ill. 298	Shells, Land, extinct on Lisiansky Island
Sausage, Smoked: Germany		3, 5, 9, 21	Shells, Venders of sea: Pueblo Bonito, N. Mex.
Save River Basin, Yugoslavia: Slavs		204	Shelters, Goat: New Mexico
Sawyer Bay, Ellesmere Island		475, 507	Shepherd, Goats with their: New Mexico
Saxifrage Family (Corabells)		75	Shinav's Wigwam, Carlsbad Cavern, N. Mex.
(color insert) Plate XXIII, 46-71		308, 309, 311, ill. 305, 306, 310	Shipbuilding yard, Strasbourg, France
Scandinavian Races (Cattle)		665	Ships, Trading: South Sea Islands
Scarfs, Weaving: Tripolitania		135	Plate III, 402-419
Scars, Heidelberg students covet		30	Shipwrecks: Hawaiian Islands
Schaffhausen, Switzerland		39	82, 103, 107-108
Scheldt River: Europe		2, 3	Shiraz, Persia
Schloss Eltz (castle): Germany		16	Shoal, French Frigate: Hawaiian Group
Schnapps (beverage): Germany		5	Shoe-button eye, Bird with a
School, Arts: Zuni Indians, New Mexico		242	Shop, Turkish: Konia
School, Refugee camp: Saloniki		582	(color insert) Plate VII, 540-557
School teacher: Manihi Island		422	Shorthorn, Celtic (Cattle)
Schouwen Island: Holland		3	604-605
Schur (Lieut.), M. A.: MacMillan Arctic Expedition		502, 503, 505, 522, 531, ill. 352	Shorthorns (Cattle)
Science in Polynesia, The Romance of. By Robert Cushman Murphy		355	ill. 684, 686, 695, 704
SCIENTIFIC ASPECTS OF THE MACMILLAN ARCTIC EXPEDITION		349	Shorthorns (Cattle)
Scientists, Tanager Scientific Expedition		77	(color insert) Plate VII, 638-679
Scotland, Reference to		180	Shrine, Street: Asia Minor
Scriptural edict concerning oxen		611-612	Shrine, Street: France
"Scuppers under": Destroyer in a rough sea		435	Sicard (Lieut.-Commander), Montgomery
			Sicily, Reference to
			Sidra, Gulf of
			Sign, Mecca guide: Tripolitania
			Sign, "1600 A. D.": Germany
			Signal bridge, Action on the: U. S. Navy destroyer
			Signals, Flag: U. S. Navy
			Signs, Information: German railway stations
			Sigsbee specimen water bottle
			Silica, Terraces of: New Zealand

	Page		Page
Silk spinning: Switzerland.....	39	South Beveland, Island of: Holland.....	3
Silver, Brass inlaid with: Metal worker, Damascus.....	214	South Carolina State Flower (Carolina-Jessamine) 72, (color insert) Plate XVI, 46-71	430
Silver dollars are not wanted: China-Tibet.....	347	South Channel, Mass.....	357
"Silver fish," Torpedoes called.....(text)	458	South Sea cult.....	(color insert)
Silver worker of Iraq (Mesopotamia).....	215	South Sea Islands.....	XVI plates, 402-419
Silvery-haired Bats (<i>Lasionycteris noctivagans</i>)..	329	South Sea Islands: Cattle.....	695
Simmental (Cattle).....	636, 653	South Sea Islands: The Romance of Science in Polynesia. By Robert Cushman Murphy.....	355
Simony, Governor: Godthaab, Greenland.....	515	South Upernivik, Greenland.....	498
Simpson (Lieut.), J. H.....	245	Southern European Stocks (Cattle).....	665, 668
Sinaun, Tripolitania.....	149	Spahi, or native cavalryman: Tripolitania (color insert) Plate I, 140-149	
Singapore, Reference to.....	117	Spain: Cattle.....	ill. 682, 706
Sining, China.....	343, 346, 347	Spalenthor (old gate), Basel, Switzerland.....	37
Sinope, Turkey.....	559	Spanish Flats, New York City (1882).....	231
Sip-soo (Eskimo): Greenland.....(text)	502	Spanish Longhorns (Cattle).....	627
Sitting Bull Falls, N. Mex.....	ill. 58	Spanish soldiers: Arizona (1804-05).....	263
Skeletons, Indian.....	564	Spearmen, Fighting: Pacific Islands.....	358
Skeletons, Indian: Pueblo Bonito, N. Mex.....	236	Spiny Cactus (<i>Coryphantha neomexicana</i>).....(color insert) Plate IX, 274-291	
Skin sack. Bird with a flame-red: Frigate Bird.....	89	Spiderflower (<i>Cleome spinosa</i> L.).....	46
Skinks (lizards): Polynesia.....	373	(color insert) Plate VII, 46-71	
Skins, Inflated cattle (river craft): India.....	615	Spiderlily, Western (<i>Hymenocallis occidentalis</i> (Le Conte) Kunth).....	44, (color insert) Plate I, 46-71
Skipper, Barge: Rhine River.....1, 2, 3, 9, 36, ill.	3	Spirit of Light (Love Tern in flight).....	ill. 87
Skulls, Mound of Christian.....(text)	133	Spitsbergen: Map (inset). Supplement, November, 1925.	
Skunkcabbage (<i>Spathyema foetida</i> (L.) Raf.).....	45	Spitsbergen, Reference to.....	350
(color insert) Plate IV, 46-71		Sports: Bullfighting (Europe).....	ill. 706, 707
Skutari (Scutari), Asia Minor.....	209	Sports: Canoe-racing, New Zealand.....129-130, ill.	128
Sky, Colors of the.....	189	Sports: Foot-racing, New Zealand.....	129
Sky-Pilot's Day, The: Church service on deck.....	446	Sports: Horse-racing, New Zealand.....	129
Slang of the sea.....(text)	448	Sports: Yacht-racing, New Zealand.....129, ill.	124
Slaughter Canyon, N. Mex.....	329, 330	Spotting practice: U. S. Navy.....	ill. 461
Slaughter Cave, N. Mex.....	329	Spring, Hamurana: New Zealand.....119, 122	
Slaughter, Colonel, Texas cattleman.....	629	Spring, Treasure (Hamurana Spring): New Zea- land.....	119, 122
Slaves, Christian: Tripoli.....	149	Stall feeding (cattle).....	634
Slaves, Southern: Save River Basin.....	ill. 204	Stalls, Cow: U. S. Soldiers' Home, Washing- ton, D. C.....	ill. 628, 631
Sleeping quarters, Sailors: U. S. Navy destroyer ill.	469	Stamboul (Constantinople).....	557
Sleet, Formation of.....(text)	178	(color insert) Plates II, III, 540-557	
Slogan, Expedition ("Felix keeps on purring")..	193	Standing Rock reservation (South Dakota).....	631
Small-eared Bat (<i>Myotis thysanodes</i>).....	324	State Park, Texas.....	301, 319, ill. 316, 317
Smallpox: Marquesas Island.....	383	Statue of Perkeo (court jester): Germany.....	31
Smallpox, Refugees die with: Greece.....	563	Statues, Gutenberg's: Europe.....	20, 26, 35
Smile, Sweet Marquesan: Maidens of Taupata Island.....	389	Statues, Mutilated (Roman ruins): Tripolitania.....	161
Smith Sound Eskimos: Greenland.....	500, 505	ill.	161
ill.	487, 489	Steamboat Rock, Columbia River.....	622
Smith Sound, Greenland.....	478	Steamer, Rhine River.....	39
502, 503, 509, 510, 524, 527, ill.	528	Steel, Age of.....	163
Smithfield (London) cattle market.....	597	Steel mills: Germany.....	6, ill. 4, 5
Smoke contains cloud nuclei.....	174	Steele, Captain of the <i>Peary</i>	487, 493, 500
Smoke-screen attack on the battleships.....	465, 467	Stein-am-Rhein, Switzerland.....	ill. 41
ill.	457, 471	Stein, Switzerland.....	39
Smokestack, Painting a: U. S. Navy sailors.....	ill. 450	Stevenson, Robert Louis, References to.....	357
Smyrna (Turkey), Burning of (1922) and the refugees.....533, 534-535, 539, 557, 561, 566, 568	ill. 538, 558-562, 564-566	358, 365, 379, 382, 383 (text) Plate VII, 402-419	
Smyrna Gulf.....	ill. 565	Steward George, U. S. S. <i>Tanager</i>	ill. 84
Snails, Land, and geographical distribution: Tahiti ill.	362	Stirrups, Saddle: Cavalryman of Tripolitania (color insert) Plate I, 140-149	
Snakes, Stone (Koo Vanyu): Carlsbad Cavern, N. Mex.....	310	Stockyards, Cattle in the: United States.....	ill. 605
Snow, Red lichen found on Arctic.....	515	Stone idol: Forest of Vavita (Pacific Islands).....	ill. 421
Snowflakes, Clouds and.....	163	Stone ox over Meat Hall entrance: Germany.....	ill. 626
Snows, Alpine.....	36, 37, 41, 42	Storehouses, Rat-proof: South Pacific Islands.....	ill. 372
Soaping a geyser to make it spout.....	123, 127	Storm, Electrical: Grand Canyon, Ariz.....	ill. 171
Soaps, Coconut oil used in.....(text)	374	Storm, Experiences on Board a U. S. Navy Des- troyer in a Wild Winter. By Lieut. H. R. Thurber.....	427
Society Islands, Pacific Ocean.....	355, 357, 360, 361	Storm flag signals.....	427
370, 373, 384, 385, 396, 419, ill.	369, 385	Storm, Tornado: Texas.....	ill. 174
Soda lake: New Mexico.....	317	Stormy Cape (Cape Hatteras).....	463
Soňa, Bulgaria.....	201, ill. (aerial view)	Stoves, Barge: Rhine River.....	1, 3, ill. 3
Soldier, Greek: Athens.....	574	Strait of Magellan, Reference to the.....	380
Soldiers, Best-fed: Entente Allies, European War 598, 600		Straphanger, Seagoing: Sailor on deck.....	ill. 438
Soldiers, French: Germany.....	ill. 14	Strasbourg, France.....(text)	2
Soldiers' Home, Dairy barn: Washington, D. C. ill.	628, 631	3, 26, 29, 34, 35, 36, 37, ill. 32, 33	
Soldiers, Italian colonial: Tripolitania.....	131-132	Strato-cumulus clouds.....	ill. 168, 185, 186
ill.	136, 137, 159	Stratus clouds.....	ill. 180, ill. 188
Soldiers, Italian colonial: Tripolitania.....(color insert) Plates I, IV, V, 140-149		Strawberry Cactus (plants).....(color insert)	
Soldiers, U. S.: Germany.....	11, 12, 14, 15	Plates X, XIV, 274-291	
Solomon Islands, Reference to the.....	373	Street, Market: Damascus.....	ill. 213
Song of the Bell (cowbells).....	603	Street scene: China (Chengtu).....	ill. 340
Songs, Grinding: American Indians.....	237	Street scene: Near East.....(color insert)	
Sooty Albatrosses (birds): Hawaiian Islands.....	86	Plates III, IV, 540-557	
Sooty-backed Terns (birds): Laysan Island.....	ill. 101	Street scene: Portugal.....	ill. 702
Sooty Terns (birds): Pacific Islands.....	ill. 400	Street scenes: Tripolitania.....	ill. 136, 139, 159
Sorensen, (Nels P.): MacMillan Arctic Expedi- tion.....	521, 522, 531	Streets, Narrow: Bagdad.....	217-218
Soundings, Taking: U. S. Navy sailors.....	448-449, 457	Streets, Narrow: Tripolitania.....	135
ill.	436	Streets, Unnamed: Stein-am-Rhein, Switzerland	39, 41

	Page		Page
Strings, Kite: Carlsbad Cavern (New Mexico) markers.....	304	Taro (plant): Pacific Islands.....(color insert)	77
Suara Rulway.....	151	Plates IV, XIV, 402-419	
Submarine attack, Signals for a.....(text)	432	Tarsus, Plains of: Asia Minor.....	211
Sugar cane cultivation: Pacific Islands.....	363	Tashi Lumpo, Pantshen Lama of.....	343
Sufu, China.....	337	Tasman Sea, Reference to the.....(text)	124
Sukkertoppen, Greenland.....	514, ill. 511	Tatman, (Mr.): Canyon of Death, Ariz.....	299
Sullivan, (Dr.) Louis R., Reference to.....	377	Tattooing, Maori: New Zealand.....	129
Sulphur factory, Nature's: White Island.....	120	Tattooing, Women decorated with: Tripolitania (color insert) Plates VII, VIII, 140-149	
Sulphur, Terraces of: New Zealand.....	115	Tauata Island, Marquesas.....	368, 388, 389
Sulu Sea, Reference to the.....(text)	490	Taupo, Lake: New Zealand.....	130
Sun and sea have cloud-building rivals.....	169	TAURINE WORLD, THE: CATTLE AND THEIR PLACE IN THE HUMAN SCHEME—WILD TYPES AND MODERN BREEDS IN MANY LANDS. BY ALVIN HOWARD SAUNDERS.....	591
Sun compass, Bumstead: MacMillan Arctic Expedition.....	523, ill. 520	Taurus Mountains, Turkey.....	211
SUN-PAINTED SCENES IN THE NEAR EAST. AUTOCHROMES LUMIERE BY GERVAIS COURTELEMONT. COLOR INSERT, XVI PLATES.....	540-557	Tax, Government: Turkey.....(text) Plate VI, 540-557	
Sunday feast: Rapa Island.....	419, 424-425	Tax, Grass and water: Tibet.....	347
Sunday school, Call to: Pacific Islands.....	387	Taxation, System of: Persia.....	222
Sunburst, Nature's masterpiece of the skies.....	189	Taxicab driver, British.....	192
Sundew Family (Venus Flytrap).....	75	Taxicabs, French: Paris.....	192
(color insert) Plate XXIV, 46-71		Taxidermists, Photographs as aids to.....	351
Sundrops, Common (<i>Oenothera fruticosa</i> L.).....	71	Taxiing, Bird: Getting up speed.....	108, ill. 90, 91
(color insert) Plate XI, 46-71		Teal, Laysan (bird): Hawaiian Islands.....	103
Sunsets, Clouds and.....	189, ill. 172, 177	Teal (bird), Nest and eggs of a Polynesian. (color insert) Plate XVI, 402-419	
Sunshine, Hotel board and.....	180	Tear-thumb, Arrowleaf (<i>Yrcaulon sagittatum</i> (L.) Small).....	46, (color insert) Plate VII, 46-71
Superstition, Moslem: Oxhorns bring good luck.....	579	Teeswater (Shorthorn) cattle.....	634
Surf, Water Buffaloes in the: India.....	613	Teeswater Valley (England), Cattle from.....	634
Surfside radio compass station.....	441	Tehyang, China.....	337
Susak, Yugoslavia, Reference to.....	197	Teeth, Bats have sharp.....	321
Sussex (Cattle).....	686-687	Teheran, Persia.....	222, ill. 218
Swimming pool, Sulphur: New Zealand.....	119	Telephone receivers, Milk used in making.....	596
Sweet Waters of Asia.....(color insert)		Temperament, French.....	193
Sweetmeat party, A: Near East.....(color insert)		Temperature: Bagdad.....	218
Plate III, 540-557		Temperature, Bats need uniform.....	324, 329
"Swiss Family Robinson" (book), Reference to		Temperature: Carlsbad Cavern, N. Mex.....	301
the.....	357	Temperature, Clouds and.....	167, 170, 171
Switzerland.....	1, 37, 39, 41, 220, ill. 36-38, 41-43	Temperature, Water: MacMillan Arctic Expedition.....	354
Sydney, Australia, Reference to.....	117	Temperatures, Upper air: Arctic Regions.....	351-352
Sydney, Nova Scotia.....	225, 482, 517	Temple, Coffin-filled: China.....	333
Syria, Island of (Greece): Refugee children.....	581	Temple of Seti I, Carving in the: Egypt.....	621
Syria, Crossing (by automobile).....	206	Temples, Stone: Necker Island, Hawaiian Group	
211, 214-215, ill. 213		79, ill. 80	
Syria, Fruit venders of.....(color insert)		Tenararo, Islets of: Tuamotu Archipelago.....(color insert) Plate V, 402-419	
Syria, Home life in.....(color insert)		Tenement, Bird: Laysan Island.....	100
Plates XII, XVI, 540-557		Tenements, Mud, Near Eastern refugees live in.....	564
Syrian Desert.....	211, 214-215, 219	ill. 583	
Syrian orphanage, Girl working with silver in a: Damascus.....	214	Tennessee State Flower (Maypop).....	74
Syrup, Grape: Syria.....(text) Plate XI, 540-557		(color insert) Plate XXI, 46-71	
Szechwan (Province), China.....	337, 341, 347	Tents, Market vender's: Tripolitania.....	154
ill. 335, 336, 338-340		Terns (birds): Hawaiian Islands.....	78
Szechwan-Kansu border troops: China.....	337	81, 82, 83, 86, ill. 87, 93, 94, 100, 101	
		Terns (birds): Pacific Islands.....(text) 399, 402, ill. 401	
		Terns, Sooty (birds): Pacific Islands.....	400
		Terraces, Agricultural: New Mexico.....	260
		Terraces, Pink and White: New Zealand.....	109
		110, ill. 110	
		Tewa (Indians) of the Rio Grande.....	245, ill. 244
		Texas became one of the United States (1845).....	627
		Texas cattle fever.....	629, 630
		Texas, Cattle ranches in.....	627-629, 630
		Texas Longhorn (Cattle).....	708-710, ill. 705
		Texas Longhorn (Cattle).....(color insert)	
		Plate XX, 638-679	
		Texas State Capitol and a tornado cloud.....	174
		Texas State Park.....	301, 319, ill. 316, 317
		Tewhatewha (weapon): New Zealand.....	129
		Textile Art, Prehistoric Indian: Arizona.....	300
		Thais the courtesan (in legend): Persia.....	222
		Thatched dwelling: Rapa Island.....(color insert) Plate IX, 402-419	
		The Graves, Tower of the (Massachusetts Bay).....	430
		"Thermos-bottle" cars for shipping dairy products	
		636-637	
		Theseion (temple): Athens.....	564, ill. 572
		Thetis, U. S. S.....	86
		13th, unlucky day: MacMillan Arctic Expedition.....	507
		Thirty Years' War, Reference to the.....(text)	12
		Tholen Island: Holland.....	3
		Thrace (East) retransferred to Turkey.....	540
		Thrace (Turkey).....	534, 540, 557, 577, ill. 579, 583
		Threshing machine, Ox-drawn.....	634
		Threshing with oxen: Persia.....	709
		Throne, Peacock: Persia.....	222
		Thule, North Star Bay, Greenland.....	500

	Page		Page
Thurber, (Lieut.) H. R. Collarin' Cape Cod: Experiences on Board a U. S. Navy Destroyer in a Wild Winter Storm.....	427	Trieste, Italy.....	197, ill. 200
Tibet, Agriculture in (working with Zos).....	ill. 610	Trillium, Purple (<i>Trillium erectum</i> L.).....	72
Tibet, Experiences of a Lone Geographer Through Central China to the Amne Machin Range in. By Joseph F. Rock.....	331	(color insert) Plate XVII, 46-71	
Tibet: Yak..... (color insert) Plate III, 638-679		Triplets, Calif.....	ill. 689
Tibetan grass country, References to the.....	346, 347	Tripoli derived from "Three Cities".....	149
Tibetan transport.....	ill. 618	Tripoli, 131-132, 137, 139-140, 149	
Tibetans, Choni.....	ill. 341, 342	ill. 132-136, 139, 150	
Tick, Plague giving (cattle).....	629, 630, 704	Tripoli formerly known as Oea.....	149
Tickclover, Hoary (<i>Desmodium canescens</i> DC.).....	74	Tripoli, Types in..... (color insert)	
Ticket-booking: Germany.....	26-27	Plates III, IV, VI, VIII, 140-149	
Tickles (narrow straits)..... (text)	480	Tripolitania: Map.....	138
Tidal observations: MacMillan Arctic Expedi- tion.....	354	Tripolitania: Scenes.....	ill. 132-137, 139, 150-161
Tide gauge, Arctic.....	ill. 490	Tripolitania: Under Italian Libya's Burning Sun (color insert) VIII plates, 140-149	
Tide records: Etah, Greenland.....	ill. 490	TRIPOLITANIA, WHERE ROME RESUMES SWAY: THE ANCIENT TRANS-MEDITER- RANEAN EMPIRE, ON THE FRINGE OF THE LIBYAN DESERT, BECOMES A PROMISING MODERN ITALIAN COLONY. BY COLONEL GORDON CASSERLY.....	131
Tiffany mines (turquoise): New Mexico.....	247	Tristram's Petrels (birds): Hawaiian Islands.....	103
Tigris (River), Mesopotamia.....	216, 218, 219	Troglodyte country: Tripolitania.....	159-160, ill. 160
Tikitere, New Zealand: "Devil's Porridge Pot".....	119	Tropic Birds: Hawaiian Islands.....	82
Tikitere, Valley of: New Zealand.....	ill. 115	Tropic of Capricorn, Reference to the.....	419
Tiles, Green: Turkey..... (color insert) Plate IV, 540-557		Tropics, Rain in the.....	168, 178-179
Toads: Polynesia.....	373	Troubadours, Provençal.....	20
Tobacco cultivation: Rapa Island.....	419	Trout, Arctic.....	515
Tobacco, Gifts of, to Eskimos..... (text) 487, 500, 513		Trouville, France.....	219
Tobacco shop, American's: Coblenz, Germany.....	14	Trumpets, Six-foot: Labrang monastery, China.....	345
TOILERS OF THE SKY: TENUOUS CLOUDS PERFORM THE MIGHTY TASK OF SHAP- ING THE EARTH AND SUSTAIN- ING TERRESTRIAL LIFE. BY McFALL KERBEY.....	163	<i>Tse-biya hani ahi</i> (Pueblo Bonito, N. Mex.).....	260
Tom Moore Street, Athens.....	590	Tsémed, Hassan, Tripolitania.....	149
Tom Sawyer, Reference to.....	304	Tuamotu Archipelago..... (color insert)	
Tomb of Chosroes, Persia.....	222	Plates V, XV, 402-419	
Tomb of Esther, Alleged: Persia.....	222	Tuamotu Archipelago, Map.....	366
Tomb of Mevlana Jelal ed-din Rumi: Konia, Asia Minor.....	210	Tuamotu Archipelago, Pacific Islands.....	360, 361, 363
Tomb of Murad II: Brusa, Turkey..... (color insert)		365, 373, 385, 388, 402, 419, ill. 376, 384, 387, 394	
Plate VI, 540-557		400, 422, 423	
Tomb, Saladin's: Syria.....	214	Tuareg tribespeople: Tripolitania..... (color insert) Plate II, 140-149	
Tombstone of a king: Rimitara Island.....	ill. 421	Tuberculosis: Marquesas Islands.....	383
Tonga Islands, Pacific Ocean.....	360	Tubuai Group or Austral Islands.....	419
Tongan feasts: Pacific Islands.....	358	Tufted cirrus clouds.....	ill. 181
Tongariro National Park, New Zealand.....	ill. 118	Tuliptree (<i>Liriodendron tulipifera</i> L.).....	73
Tools, Primitive Indian.....	299	(color insert) Plate XVIII, 46-71	
Torch-bearing bullocks employed by Hannibal.....	614	Tungchwan, China.....	334, 333
Tornado cloud.....	189, ill. 174	Tunisia, Reference to.....	131
Torpedo attack: U. S. Navy.....	467, ill. 456, 458	Tunny (fish): Pacific Ocean.....	ill. 364
Tortilla-maker, Indian: New Mexico.....	235	Tupik (sealskin tent): Greenland.....	510, ill. 502
Tortoise, Mouse: Germany.....	ill. 23, 25	Tureia Island, Tuamotu Group.....	ill. 375, 384, 390
Towers of Anatoli Hissar (Anatolian Castle): Sweet Waters of Asia..... (color insert) Plate III, 540-557		Turkestan, Chinese.....	347
Townshend, (Gen.): British Army.....	218	Turkey and Greece Exchange Two Million of Their People. By Melville Chater.....	533
Toys, Indian children's: Pueblo Bonito, N. Mex.....	241	Turkey-in-Europe, Outpost of: Adrianople.....	204, ill. 209
Tractor, American: Syrian Desert.....	211, 214	Turkey-in-Europe's long road of 1453-1923.....	567
Trade center, Aleppo (Syria).....	211	Turkey, Scenes in..... (color insert).....	Plates I-VIII, 540-557
Trade winds, Birds in the: Laysan Island.....	ill. 101, 102	Turkish army enters Smyrna (1922).....	535
Trade winds, Reference to the.....	365	Turkish boy: Yugoslavia.....	ill. 205
Trades, Jews control the: Tripolitania.....	138-139	Turkish frontier, Bulgarian.....	204
Traffic, Automobile: Paris.....	192	Turkish quarters: Smyrna.....	533, 539
Traffic, Rhine River.....	9, 21, 22, ill. 2, 15, 33	Turkish Republic.....	557, ill. 536
Tragedy Stalks Through the Near East as Greece and Turkey Exchange Two Million of Their People. By Melville Chater.....	533	Turkish women: Asia Minor.....	ill. 212
Trail, Butterfield: New Mexico.....	317	Turks back in Constantinople.....	557
Trail, Oregon: U. S. West.....	629	Turquoise deposits: New Mexico-Arizona.....	247
Trail, Rainbow Natural Bridge: Arizona..... (color insert) Plate VII, 274-291		Turquoise driller, Indian.....	ill. 247
Trail, Santa Fé: U. S. West.....	629	Turquoise necklace.....	227, 229, 246, ill. 239
Train, Refugee: Near East.....	ill. 568	Turquoise necklace..... (color insert) Plate IV, 274-291	
Train service, Germany.....	27, 29	Turquoise ornaments, Indian: New Mexico.....	227
Trains, Cattle: United States.....	ill. 636	229, 245, 246, 273, 291, ill. 236, 239, 273	
Transportation, Automotive: From England to India by Automobile. By Maj. F. A. C. Forbes- Leith.....	191	Turquoise, Value of, to the Indian.....	246
Transportation system, Tibetan: Yak.....	ill. 618	Turtles, Sea: Lisiansky Island, Hawaiian Group.....	ill. 104
Treaty, Lausanne.....	564, 572	ill. 97	
Treaty, Sévres.....	540	Twin Domes, Carlsbad Cavern: New Mexico	ill. 303, 311
Trebizond (Turkey)..... (text) 537, 559, 576		Twins, Calif.....	ill. 688
Tree, Birds nesting in a single: Laysan Island.....	100	Twin Geyser, New Zealand.....	ill. 122
Tree Ferns: New Zealand.....	ill. 121	Tusk, Narwhal (or sea unicorn): Greenland.....	ill. 500
Trees: Hawaiian Islands.....	77, 103, 106, ill. 100	Type, Rapa Island.....	ill. 356
Trek, History's Greatest: Greece and Turkey Ex- change Two Million of Their People. By Mel- ville Chater.....	533	"Typee" (book) by Herman Melville.....	355, 357
Trèves, Archbishop of: Residence (1348).....	26	Types, Polynesian..... (color insert)	
		Plates I, VI, VIII, IX, XIV-XVI, 402-419	
		Typhus, Refugees die with: Greece.....	563

U

Ujaragssuit, Greenland: Norse ruins.....	ill. 516
Ulid, Tripolitania.....	149
Umanak Fiord, Greenland..... (text) 484	
Umanak, Greenland.....	498, ill. 483, 484
Umbrella-wort, Heartleaf (<i>Allionia nycotaginea</i> <i>Michx.</i>).....	71, (color insert) Plate XII, 46-71

	Page
Umiak (women's boat): Greenland.....ill.	514
UNDER ITALIAN LIBYA'S BURNING SUN.	
AUTOCHROMES LUMIERE BY LUIGI	
PELLERANO. COLOR INSERT, VIII	
PLATES.....	140-149
Unemployment: Paris.....ill.	192
Unicorn, Tusk of a sea: Greenland.....ill.	500
Uniform, Greek Palace Guard: Athens.....ill.	574
Uniforms, Italian colonial troop.....ill.	136, 137, 159
Uniforms, Italian colonial troop.....(color insert)	
Plates I, IV, V, 140-149	
Union Group: Pacific Islands.....	360
U. S. Army of Occupation, American: Germany.....	11
12, 14	
U. S. Biological Survey.....	77, 78
U. S. Bureau of Animal Industry.....	629, 637
United States, Cattle in the.....(text)	594, 597
ill. 594, 605, 622, 625, 628, 635, 680,	
189	
United States, Clouds and the.....	167, 179, 180,
189	
U. S. Coast and Geodetic Survey.....	354
U. S. Coast and Geodetic Survey flag: Greenland	
ill.	490
United States coöperates with MacMillan Arctic	
Expedition.....	225
U. S. Department of Agriculture.....	603, 636
U. S. Hydrographic Office charts.....	85
U. S. National Monument: Carlsbad Cavern	
(New Mexico), New Discoveries in. By Willis	
T. Lee.....	301
U. S. National Monument: Chaco Canyon (New	
Mexico): Everyday Life in Pueblo Bonito. By	
Neil M. Judd.....	227
U. S. Navy and Near East relief.....	540
ill. 558-560,	
562	
U. S. Navy Department.....	77, 86
U. S. Navy Destroyer, Experiences on Board a:	
Collarin' Cape Cod. By Lieut. H. R. Thurber	
.....ill.	427
U. S. Navy destroyers.....ill.	428-439, 442
444-449, 451, 453, 456-472	
U. S. Navy flyers: Arctic Regions.....	473, 475
U. S. Navy in Arctic history.....	519
U. S. Navy: MacMillan Arctic Expedition.....	473
U. S. Navy Planes Make First Series of Over-	
land Flight in the Arctic: The MacMillan Arctic	
Expedition Returns. By Donald B. MacMillan	
U. S. Navy: Scientific Aspects of the MacMillan	
Arctic Expedition.....	349
U. S. Navy Yard (Boston).....	427, 433, ill.
428	
U. S. S. <i>Saginaw</i>	107, 108
U. S. S. <i>Tanager</i>	77, 81, ill.
78	
U. S. S. <i>Tennessee</i> , Control room of the.....ill.	440
U. S. S. <i>Thetis</i>	86
U. S. Soldiers: Germany.....	11, 12, 14,
15	
U. S. Soldiers' Home, Washington, D. C.: Dairy	
barns.....ill.	628, 631
180, 189	
U. S. Southwest.....	274-291
(color insert) Plates I-III, V-XVI,	
U. S. Southwest: Bats of Carlsbad Cavern (New	
Mexico). By Vernon Bailey.....	321
U. S. Southwest: Everyday Life in Pueblo Bonito	
(New Mexico). By Neil M. Judd.....	227
U. S. Southwest: Exploring in the Canyon of	
Death (Cañon del Muerto, Arizona). By Earl	
H. Morris.....	263
U. S. Southwest: New Discoveries in Carlsbad	
Cavern, New Mexico. By Willis T. Lee.....	301
"Up and over": U. S. sailors painting a smoke-	
stack.....ill.	450
Urus (breed of cattle).....	604-605
Utah: Scenes.....(color insert)	
Plates II, III, 274-291	
"Uttermost Thule" of the Pacific (Rapa).....	388

V

Vaduz, Liechtenstein.....	41
Valley, Geyser: New Zealand.....ill.	114, 115, 122
Valley, Monument: Utah-Arizona border.....(color	
insert) Plates II, VI, 274-291	
Valley of Tikitere, New Zealand.....ill.	119, ill.
116	
Valley, Omoa: Fatuhiva Island.....(color insert)	
Plates II, VI, 402-419	
Valley, Rhine River.....ill.	7, 13, 18, 23-27,
40	
Valley, Waitapu: New Zealand.....ill.	123
Valleys carved by water.....	163
Vancouver, (George), References to.....	358, 419
Vanderbilt, "Commodore," Reference to.....	628
Vanilla cultivation: Pacific Islands.....	363
Vapor, Clouds and.....	167, 168, 170, 171, 174, 180

	Page
Vaulted street: Tripoli.....ill.	139
Vavitao Island, Austral Group.....ill.	369, 421
Vavitao Island, Austral Group: Map.....	369
Vegetation, Clouds and.....	163, 177, 178, 180
Vegetation: Polynesia.....	366, 369, 370-371
Vehicle, Venice's lack of.....	196
Veiled men of the Sahara.....(color insert)	
Plate II, 140-149	
Veiled women, Turkish.....ill.	212
Vender, Bread: Tripolitania.....	137, ill.
150	
Vender of wooden pails: Fiume.....ill.	202
Venders, Fruit: Turkey.....(color insert) Plate XI,	
540-557	
Venders, Parrot: Mexico.....	247
Venders, Shell: Pueblo Bonito, N. Mex.....	247
Venice, Italy.....	29, 36, 196, ill.
199	
"Venice of Greenland," Sukkertoppen, Greenland.	
514	
Ventilation, Aboriginal peoples not concerned with	
252	
Venus Flytrap (<i>Dionaea muscipula Ellis</i>).....	75
(color insert) Plate XXIV, 46-71	
Venus, Statue of (Roman ruins): Tripolitania.....	161
Vera Cruz, Mexico.....	247
Verhoeff Glacier, Greenland.....ill.	529
Victoria, Tripoli and the workaday.....ill.	152
Victory, Sacrifice to: Smyrna.....	539
Village, Eskimo: Greenland.....(text)	504, 510, 511, 513
Village, Negro: Tripolitania.....ill.	157
Village, Troglodyte: Tripolitania.....	159-160, ill.
160	
Villages, Prehistoric cliff: Arizona.....ill.	268-271
Vineyards, Terraced: Rhine Valley.....ill.	18, 23-25
Violin, Man playing: Labrador.....ill.	482
Vipers-bugloss (<i>Echium vulgare L.</i>).....	45
(color insert) Plate V, 46-71	
Virginia Beach, Reference to.....	455
Virginia State Flower (Flowering Dogwood), 46,	
71	
(color insert) Plate X, 46-71	
Vogler's, (Abt), demon builders.....	180
Volcanic core, Tahiti's eroded.....ill.	362
Volcano, Mount Tarawera: New Zealand.....	109
110, ill.	
111	
Volcano, Mud: New Zealand.....ill.	123
Volcano, Ngauruhoe: New Zealand.....ill.	118
Volcanoes, Clouds and.....	174, ill.
169	
Vorder Rhine, Switzerland.....	41, 42,
43	
"Voyages," Cook's, (James).....	358

W

Wagner, Richard.....	5, 14
Wagon, Farm: Germany.....ill.	18
Wagon, National Geographic Society's: Arizona.	
ill.	265
Waikato River, New Zealand.....(text)	128
Waikite Geyser: New Zealand.....	123
WAIMANGU AND THE HOT-SPRING COUN-	
TRY OF NEW ZEALAND: THE WORLD'S	
GREATEST GEYSER IS ONE OF THE	
MANY NATURAL WONDERS IN A LAND	
OF INFERNO AND VERNAL PARADISE.	
BY JOSEPH C. GREW.....	109
Waimangu Geyser, New Zealand.....	109
113, 116-117, 130, ill.	
111, 112	
Waiotapu Valley, New Zealand.....ill.	123
Waipa River, New Zealand.....(text)	128
Wairakei Geyser, Great: New Zealand.....	130, ill.
114	
Wairoa Geyser: New Zealand.....	123, 127
205	
Wali, or Governor: Turkey.....	140, ill.
156	
Wall, Defensive: Tripoli.....	ill.
424	
Wall, Prehistoric lichen-covered: Rimitara Island	
ill.	424
Walls, Canyon: Arizona.....(color insert)	
Plates I, VII, VIII, 274-291	
Walnut Canyon, N. Mex.....	329
Walpi, Ariz.....ill.	233
Walrus: Arctic Regions.....	505, 522, ill.
488, 491	
War Club, Shinay's: Carlsbad Cavern, N. Mex..	
305	
War Dance, Comanche (Indians).....ill.	257
War dance: New Zealand.....	128, ill.
129	
Warbler (<i>kokikoko</i>): Christmas Island.....	402
Warrior clouds.....	171
Warrior, Pacific Island.....ill.	384
Warriors, Maori: New Zealand.....	128, ill.
129	
Wash day on deck: Sailors washing their clothes	
ill.	444
Wash day, South Sea Islands.....(color insert)	
Plate VI, 402-419	
Washing custom, Mohammedan: Constantinople.ill.	211
Washing the deck, Sailors: U. S. Navy de-	
stroyer.....ill.	468

	Page		Page
Washington (State): A foster mother to elk calves	ill. 635	White, Jim: Carlsbad Cavern, N. Mex.	314-315, 330
Washington, D. C., U. S. Soldiers' Home dairy at	ill. 628, 631	ill. (distant view)	304
Washington, (Gen.) George, Reference to	634	White Oxen: France	ill. 698
Washington (State), Water power in	179, 180	White Terraces: New Zealand	ill. 110
Watchman, Night: Turkey	(text)	Whitney, Harry Payne	384
	Plate III, 540-557	Whitney South Sea Expedition	(text) 364, 384-385
Water, Amount of, in clouds	175-177	388, 389, 402, 419, 423, 424-426, ill. 425, 426	
Water Buffalo	603, ill. 611-613	Whitney South Sea Expedition schooner	(color)
Water Buffalo (<i>Bos bubalus</i>): India	(color)	insert) Plate IV, 402-419	
insert) Plate V, 638-679		"Wideawakes" (birds): Pacific Islands	ill. 400
Water Buffalo, Indian (<i>Bos bubalus</i>)	641, 644	Wife, head of the house: Pueblo Bonito, N. Mex.	232
Water-jars, Turkish	(color insert)	233, 234	
	Plate X, 540-557	Wilbur, Curtis D.: Secretary of the Navy	225
Water pipes (narghiles), Desert Arabs smoking	ill. 217	525, 527	
Water power, Clouds and	177, 179, 180	Wild Flowers, American: Pages From the Floral Life of America	44
Water supply: Carlsbad Cavern, N. Mex.	313	WILD FLOWERS OF NORTH AMERICA. PAINTINGS BY MARY E. EATON. COLOR INSERT, XXIV PLATES, 46-71	
	315, 316, ill. 310	Wild White Cattle	605-606, 645, ill. 690
Water supply, Fresh: Austral Island	(color)	Wild White (or Park) Cattle: Great Britain (color insert) Plate VI, 638-679	
insert) Plates I, XV, 402-419		Wilkes, (Charles), References to	358, 419
Water supply: Pueblo Bonito, N. Mex.	229	Williams, Maynard Owen: MacMillan Arctic Expedition	479, 513
	261, ill. 260	Willistan, (Mr. and Mrs.): Missionaries in China.	337
Water-supply system, Cologne's	9	Wilson, James, Reference to	358
Water-supply system, New York City's	176-177	Wind, Rock weathered by sand and: New Mexico	ill. 256
Water vapor region	167-168	Windmills: Holland	2, 5, ill. 703
Waterfalls, Rhine River: Switzerland	ill. 38	Windmills: Sand Island, Hawaiian Group	106
Waterfalls, Sitting Bull: New Mexico	ill. 318	Winds, Clouds and	167, 171, 174, 180
Waterfalls, Whangarei: New Zealand	ill. 121	Windy Tickle, Labrador	495
Waterfront, Trieste, Italy	ill. 200	Wine, Rhine	1, 10, 11, 18
Waterfront, Tripoli's	ill. 133	Winged lion column of Venice	ill. 199
Waterlily Family (American Lotus)	75	Winslow, Edward, Governor of Plymouth Colony	633
(color insert) Plate XXIV, 46-71		Winter, Cattle in: Sagebrush country	ill. 595
Watershed, New York City's	176	Wireless reports, MacMillan Arctic Expedition	349-350
Waterways, Inland: Rhine River	ill. 8	Wiscasset, Me.	(text) 352, 482, 518, ill. 517
12, 14, 15, 17, 21, 23-27, 36, 38		Wishing custom, Asia Minor	ill. 210
Waterways, Strasbourg (France) is a plexus of (text) 32, 34		Wolfach Valley region, Germany: Letter carrier	34
Waves, Sunlight	189	Wolseley automobile: England to India Automobile Expedition	191
Wax Currant (<i>Ribes cereum Douglas</i>)	71	Wolves, Graves raided by: China	334
(color insert) Plate XIII, 46-71		Woman, Anatolian	ill. 210
Wealth measured by the herds	612	Woman threshing grain: Thrace	ill. 577
Wealth: Pueblo Bonito, N. Mex.	247	"Woman's Rights": Pueblo Bonito, N. Mex.	232
Weapons, Soldiers with their: Tripolitania. (color insert) Plates I, IV, V, 140-149		233, 234	
Weather forecasting: MacMillan Arctic Expedition	351-354	Woman's work is never done	237
Weaver-finches: Tahiti	394	Women, Arab: Tripolitania	137
Weavers, Carpet: Yugoslavia	ill. 203	Women, German farmer	7, 13, 18, 22
Weavers (birds): South Sea Islands	(text) 360	Women, Maori: New Zealand	128-129, ill. 128, 130
Weaving, Indian girl: New Mexico	ill. 251	Women poi dancers: New Zealand	ill. 125
Weaving, Indians were masters of	299	Women's boat (umiak): Greenland	ill. 514
Weaving rugs, Greek girls	564, 584, ill. 585	Women's canoe race: New Zealand	ill. 128
Weaving scarfs: Tripolitania	135	Wood, Beads of	292
Wedge-tailed Shearwaters (birds): Laysan Islands	103	Wood-carver, Marquesan	ill. 377
	104, ill. 95	Wood carving, School of: Germany	(text) 6
Well, Island: Tuamotu Archipelago	(color)	Wood work, Indians were skilled in	300
insert) Plate XV, 402-419		Wooden pails, Vender of: Fiume	ill. 202
West Highlander (Cattle)	679, ill. 619	Woodrush, Common (<i>Juncoides campestris</i> (L.) Ktze.)	75, (color insert) Plate XXIII, 46-71
West Highlander (Cattle)	(color insert)	Wool for carpet weavers: Yugoslavia	ill. 203
Plate XV, 638-679		World, Cattle of the	(color insert)
West Indies, Cattle trade and the	634	XX plates, 638-679	
West Virginia State Flower (Rosebay Rhododendron)	72, (color insert) Plate XVI, 46-71	World's champion dairy cow	ill. 685
Western Settlement of the Norseman: Godthaab, Greenland	515	Worms, Germany	5, 27, 29
Western Spiderlily (<i>Hymenocallis occidentalis</i> (Le Conte) Kunth)	44	Wroe, Allan, of Leeds	191, 215, 222, ill. 208
(color insert) Plate I, 46-71		Würzburg, Germany	21
Wetmore, Alexander. Bird Life Among Lava Rock and Coral Sand: The Chronicle of a Scientific Expedition to Little-known Islands of Hawaii	77		
Whakarewarewa, New Zealand: Hot springs	122		
	123, 127, ill. 117		
Whaleboat, Treasured: Pitcairn Island	ill. 392		
Whalebone gateway: Greenland	ill. 503		
Whangarei Falls, New Zealand	ill. 121		
Wheel, Irrigation: China	ill. 339		
Wheel of the <i>Bowdoin</i> (ship), At the: Donald B. MacMillan	ill. 224		
Wheelbarrow, Coolies working with a: Pacific Islands	ill. 390		
"When a Feller Has a Friend" (boy and cow)	ill. 607		
Whirling dervishes: Asia Minor	210, ill. 212		
Whisk brooms: Turkey	(color insert)		
	Plate IX, 540-557		
White-breasted Petrels (birds): Hawaiian Islands	103		
"White-faces" (Hereford Cattle)	ill. 680		
White Island, New Zealand	ill. 120		

X

Xanten, Germany	5
-----------------------	---

Y

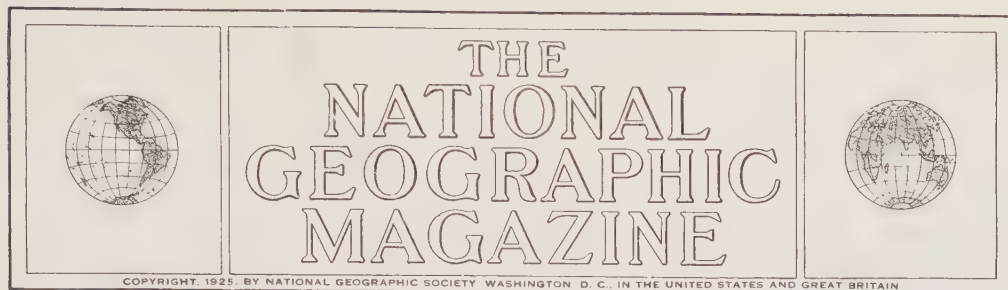
Yacht-racing: New Zealand	129, ill. 124
Yak, Bison is a cousin of the	603, 604
Yak (<i>Bos (Poëphagus) grunniens</i>)	640
Yak (<i>Bos grunniens</i>): Tibet	(color insert)
	Plate III, 638-679
Yak, Tibetan transport system consists of the	ill. 618
Yakoutang (pass), China	334
Yang, Governor of Chengtu, China	337
Yangtze River, China	337, 340
Yellow (Hwang) River, China	343, 346, 347
Yeshil Turbeh (Green Tomb): Turkey	(text)
	Plate IV, 540-557
Yichehsün, China	331, 333, 334
Yoke, Oxen wearing carved: Portugal	ill. 702

	Page
Young, (Sir) Allen, <i>Pandora</i> ship of.....(text)	485
Young, Bats in flight, carrying their.....	322-323, 330
	ill. 320, 327
"Young Bull" (painting) by Paul Potter.....	ill. 609
Yuan Shih-kai three-year dollars: China.....	367
Yucca seeds, Beads of.....	292
Yugoslavia, Crossing.....	197, 198, 201, ill. 203-207
Yuma, Ariz.: Hotel.....	180
Yunnan (Province), China.....	331, 333, ill. 332
Yunnan Government, China.....	332
Yunnanfu, China.....	331

Z

Zama, Battle of (B. C. 202).....	149
Zebu Cattle, Brahman (<i>Bos indicus</i>).....	640-641
Zebus, Dorsalhumped.....	6 to

	Page
Zeland, Province of: Holland.....	3
Zeland's heraldic device: Swimming lion.....	3
Zenith (radio) equipment.....	476
Zenith laboratories.....	482
Zibun (tunic of fine material), Arab wearing the.....	217
Zigzag Bladderwort (<i>Utricularia macrorhiza</i> <i>Le Conte</i>).....	46, (color insert) Plate IX, 46-71
Zodiac, Ox form in the figures of the.....	610
Zones, Cloudless.....	168, 180, 189
Zos (Yak-Zebu): Tibet.....	610
Zufi Corn-grinding Dance.....	257
Zufi Indian country.....	623
Zufi Indians.....	233, 238, 245, 246, 253
.....	ill. 234, 242, 244, 246, 251, 257
Zufi, N. Mex.....	237, 243
Zufi Pueblo: Young mothers.....	249



REDISCOVERING THE RHINE

A Trip by Barge from the Sea to the Headwaters of Europe's Storied Stream

BY MELVILLE CHATER

AUTHOR OF "THROUGH THE BACK DOORS OF BELGIUM," "THROUGH THE BACK DOORS OF FRANCE,"
"ZIGZAGGING THROUGH SICILY," ETC., IN THE NATIONAL GEOGRAPHIC MAGAZINE

"**W**HY not discover the Rhine?" That was the question my friend put to me as we strolled on the Scheldt-side promenade at Antwerp, watching great barges glide downstream on the first lap of Belgium's water connection with Germany and Switzerland.

I replied that explorers had anticipated us by a couple of thousand years, and my friend retorted, "Sure! But just what do you and I know of the Rhine?" And it must be confessed that, beyond the fact that the Rhine rises in Switzerland and flows into the North Sea, our informational stock was limited to Rhine legends, Rhine castles, the Rhine occupation, and Rhine wine.

It really did seem that, as far as we were concerned, the famous old river stood in need of rediscovery.

That afternoon we started about it. Our first find was a Flemish barge captain lounging aboard his craft, which was propitiously named *Rijn-Schelde*, or Rhine-Scheldt. We informed him of our ambition to ascend the Rhine on a canal boat.

Though obviously a bit puzzled as to why we should prefer that method of travel, he took us to a small inn in the Koeipoortstraate and introduced us to his

wife. She was a tired-faced woman, apparently in the worst of humors with her husband. After a moment's colloquy she expressed her willingness to stay behind, this trip, to make room aboard for us.

"But the beautiful Rhine scenery, the romantic castles—oh, madame!" we said self-reproachfully, in deprecation of her sacrifice.

"Huh!" madame returned heavily. "I'm going to take a vacation from scenery and castles! I'm going to have a real good time just sitting here and watching folks pass by. You see, I've been going up and down the Rhine in the *Rijn-Schelde* ever since we were married, and that's 12 years."

IN COFFINLIKE BUNKS

That night we groped through a pitch-black labyrinth of quays, boarded the *Rijn-Schelde*, stumbled over her deck cargo of oil barrels, and at length plunged down a steep companionway into the bow cabin. It was trianguloid and measured exactly four paces by three. It contained a miniature cook stove, a table, two chairs, and a pair of what resembled built-in pews. That was all the kerosene lamp's dim light revealed.

"Phew!" ejaculated my friend, after we had economically disposed our persons



Photograph by Melville Chater

THE STEAM BARGE "RIJN-SCHELDE"

On this Flemish craft the author and his companion made a leisurely trip from Antwerp, by way of the Hansweert Canal, to Rotterdam, and thence up the Rhine as far as Strasbourg, at which point they transferred to a boat of lighter draft, which took them to Basel, in Switzerland.

and our single piece of luggage in this closetlike space. "Happy thought, that of yours, our taking only one suitcase. There wouldn't have been room enough for two. And where do we sleep?"

This mystery was solved when the skipper came aboard at midnight. He slid back two panels, thus revealing a couple of small caves, each fitted with a narrow bunk. A spacious gesture indicated that all this was at our disposal.

We undressed, then inserted ourselves into the coffinlike bunks, according to sleeping-car technique. "Hey!" called my friend, "is your Pullman built on a curve?" It certainly was, following the curve of the ship's side; but one soon learned to fall asleep while lying in the shape of a slice of melon.

A terrific clatter of anchor chains announced that we were off on the dropping tide. By dawn we had got into our blue jeans, and were on deck to watch the

Rijn-Schelde pass through the three big locks that divide the maritime section of the Scheldt from the Hansweert Canal.

WE GLIDE THROUGH A CANAL LOCK INTO HOLLAND

It isn't often that a traveler passes from one country to another through a canal lock, yet that is practically what happened as the first pair of great gates closed behind us. And, almost as if it had been staged for our arrival, we beheld a high, green dike where three girls—their black, tight-waisted skirts blown voluminously out behind, their snowy caps uptilted at the corners—walked in single file past a red mill which was churning its sails against the sky.

The sight was so completely typical that we chimed with one accord "Holland!"

A couple of rosy-cheeked Dutch customs officials came aboard, placed seals



Photograph by Melville Chater

DECK COOKING ON THE "RIJN-SCHELDE"

From Antwerp to Strasbourg the skipper of the barge on which the author made his trip was also the cook, as madame, after 12 years of uninterrupted voyaging, wished a vacation from scenery and castles (see text, page 1).

on the *Rijn-Schelde's* cargo, then retired, meanwhile scratching their heads over the mystery of two Americans who apparently enjoyed life among oil barrels on a barge.

The Hansweert Canal, though entirely in Dutch territory, is Belgium's short cut to Rotterdam and the Rhine. Its five miles of length constitute a busy scene of maritime vessels and 2,000-ton barges gliding between flat shores. High, indeed, must be the dikes and powerful the locks of this canal, which cuts across the little island of South Beveland and connects what are practically two arms of the sea.

Another pair of huge locks opened to let us pass out into the lagoonlike Eastern Scheldt. Here the *Rijn-Schelde* sped up to 15 miles an hour, as we coasted among the islands of Tholen, Schouwen, and Beyerland, low and hazy, their files

of spectral trees flat against the horizon—a seascape-landscape of gentle grays.

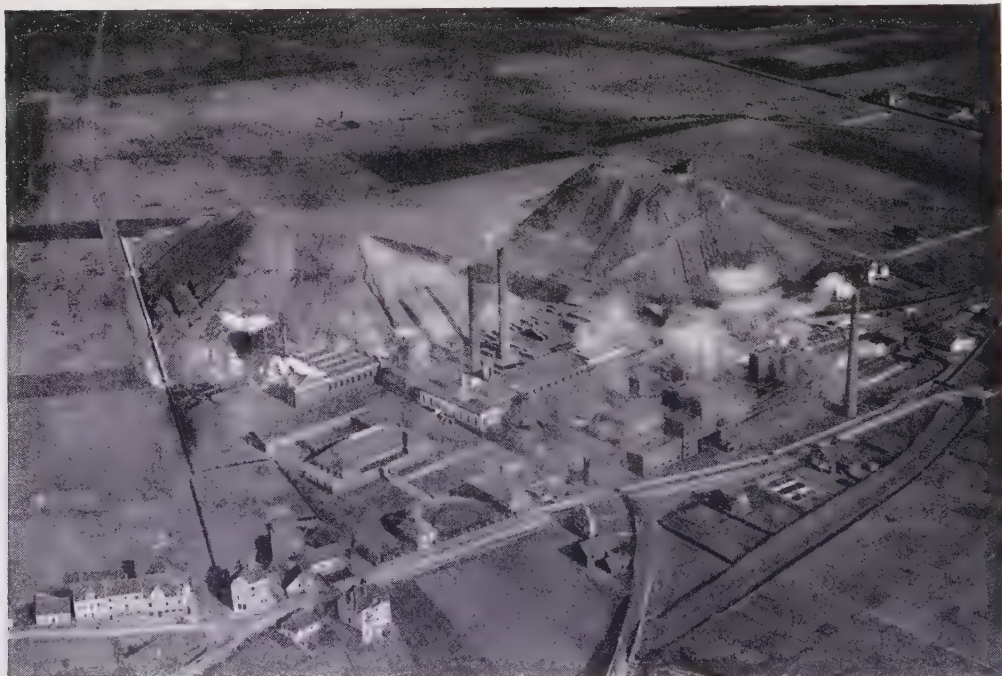
Such is the Dutch province of Zeeland, and never was a geographical name more apt. "Sea-land" consists of seven islands which, as their vast embankments bear witness, have literally been salvaged from the sea. Small wonder that these so-called "drowned lands," which have suffered two great inundations, took as their heraldic device a swimming lion; while as a motto they might well adopt the Dutch proverb, "God made the sea; we made the shore!"

Meanwhile the skipper lighted a fire in the deck stove and boiled some coffee, which grew tepid before he served it. The rest of our first barge breakfast was produced from his hip pocket. At first we took the thing to be a policeman's night-stick. It turned out to be three feet of smoked sausage, but doubtless it



Photograph from Melville Chater

AN INTERIOR VIEW OF ONE OF THE RUHR DISTRICT STEEL WORKS



Photograph by Deutscher Aero Lloyd

LOOKING DOWN UPON ONE OF THE INDUSTRIAL PLANTS IN THE RUHR DISTRICT

Shrouded in smoke by day and lit by furnace flares at night, with whistles screeching as if a great merchant fleet were lost in a fog, this throbbing, teeming district of Germany is the great industrial heart of western Europe.

would have proved a handy weapon in a pinch.

"No woman around to bother us!" he grinned, sawing up the sausage with a clasp knife. "Oh, we'll have a fine trip!"

INVESTIGATING THE SOURCES OF TWO RHINE LEGENDS

Flat Dutch landscape — green meadows, spotted cattle, and red windmills, neatly "composed," as painters say, into ready-made pictures — accompanied us all that day. Toward sunset we anchored at Lobith, the last village before crossing the German frontier.

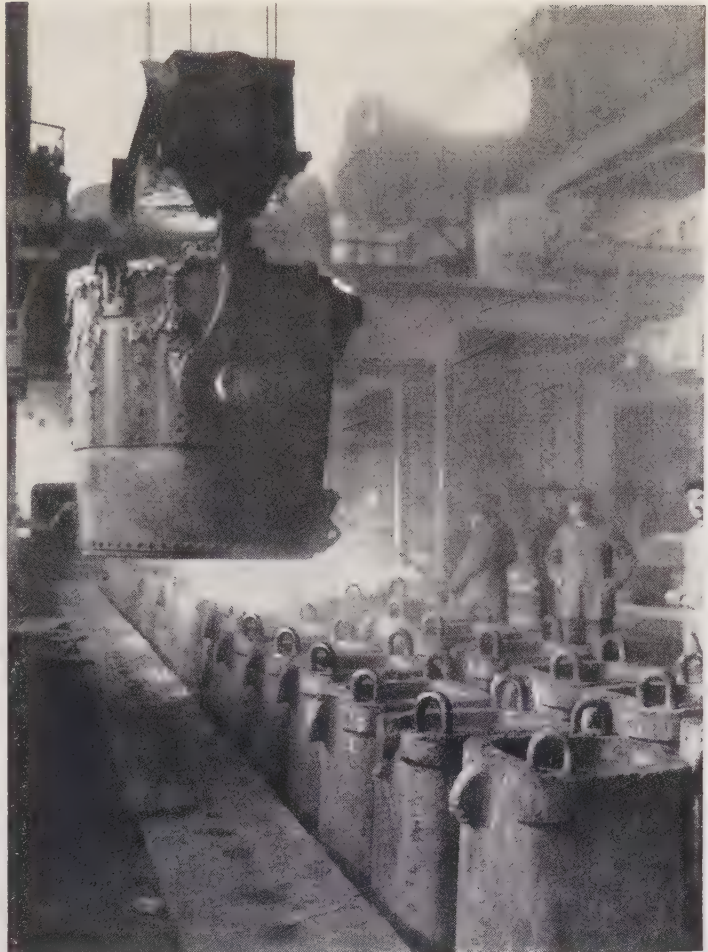
The local shops were full of barge skippers, laying in supplies for the long Rhine trip. Among them we recognized our man, who, to our dismay, was acquiring many lengths of hard, smoked sausage.

Then all hands withdrew to a near-by café. Here, unlike the landlubbers, who were swallowing small, fiery drams of schnapps in quick succession, the skippers yarned for an hour over a glass apiece of sweetish beer, then returned aboard.

In bed by nine, up by five, and a day of endless responsibility on a difficult and often crowded stream — such is the life of the average barge skipper on the Rhine.

At Emmerich, where the German officials came aboard next morning, a day's delay enabled us to visit the sources of two Rhine legends.

At near-by Cleve we paid homage to Lohengrin's monument; for here, says tradition, came the mysterious, swan-drawn knight to rescue Elsa from the toils of the usurping Telramund; and



Photograph from Melville Chater

PART OF THE STEEL WORKS OF THE DORTMUND UNION, DORTMUND, EAST OF ESSEN

from here he departed as mysteriously, via the same Rhine swan service, to furnish an opera libretto for Richard Wagner.

The other legend source was at the quaint little town of Xanten. Here is the putative birthplace of Siegfried, the hero of the "Nibelungenlied" epic, and, incidentally, one of the first Rhine tourists. At the age of 13, Siegfried got that "See-Germany-First" impulse and started upstream on his Rhine exploits.

With the exception of a trip to Iceland, where he captured and captivated the fire-surrounded Brunhild, all his legendary adventures took place in the Rhineland, between Xanten and Worms, a distance of about 200 miles.



Photograph © Kadel and Herbert

CALCAR, ON THE LOWER RHINE

This small town, northwest of Essen, is one of the most picturesque spots of Germany. In the 15th century it was the seat of a famous school of wood carving, and its Gothic cathedral is a veritable museum of this art. In the center of the market place (central foreground) is a statue of the Prussian general Seydlitz, the famous cavalry officer whose superb horsemanship has given rise to many stories, one of which relates that he once rode between the sails of a windmill in full swing. But Calcar does not claim that it was the windmill shown in the background of this photograph.

Early next morning the *Rijn-Schelde* was under way, headed for the Ruhr district. All day long its proximity was evidenced by the passage of barges, banked high with coal, for France and Belgium. During that week 444,000 tons of reparations coal moved from the mines.

THE RUHR DISTRICT SEETHES WITH INDUSTRY

We passed through much of the Ruhr after dark, and thereby perhaps had the most striking view of it. The light of the upleaping flares from its blast furnaces from time to time momentarily threw into relief that vast labyrinth of wharves, stacks, mills, railway tracks, and pit heads, where labor more than 2,000,000 men.

Oberhausen, Essen, Rheinhausen, Duisburg, Ruhrort, Meiderich—these industrial centers follow so closely upon each other as to produce one colossal effect.

The last three compose, in fact, one community, whose combined water fronts form what is probably the largest river harbor in the world.

The Ruhr district produces per year about 6,000,000 tons of pig iron and from 4,000,000 to 5,000,000 tons of steel. During 1924 its average monthly yield of coal was 8,000,000 metric tons. The five big groups of iron and steel manufacturers employ about 1,500,000 men, while the coal workers number about 550,000.*

The ancient compilers of the "Nibelungenlied," who fabled the Rhine underworld as alive with metal-working gnomes, would indeed rub their eyes could they behold how completely man's works on the Ruhr have dwarfed their poetic imaginings.

* See also "The Story of the Ruhr," by Frederick Simpich, in the NATIONAL GEOGRAPHIC MAGAZINE for May, 1922.



Photograph from Ernest Peterffy

PLANTING POTATOES IN THE RHINE VALLEY

Many German girls now find it necessary to improve their fortunes by farming.

Quite a different spectacle awaited us farther along, where Cologne's great cathedral spires towered over the Rhine like two fingers pointing the surrounding city to heaven (see page 8).

Whether by reason of its superb position or its commanding loveliness, Cologne minster dominates its city almost overwhelmingly. One comes to regard it as some gorgeous Gothic flower, and the town as merely the nourishing soil which brought it forth.

IN THE SHADOW OF COLOGNE'S CATHEDRAL SPIRES

Radiating from the cathedral extend the tree-lined boulevards which, 50 years ago, arose out of Cologne the old, the crooked-alleyed, whose tumble-down city walls were then razed to comport with the dignity of this great Rhine port.

But whatever route one may take, whether through the fashionable shopping quarter or down through the few remaining alleys of gabled house fronts, the cathedral's twin spires beckon one to return.

And time and again one does return, to

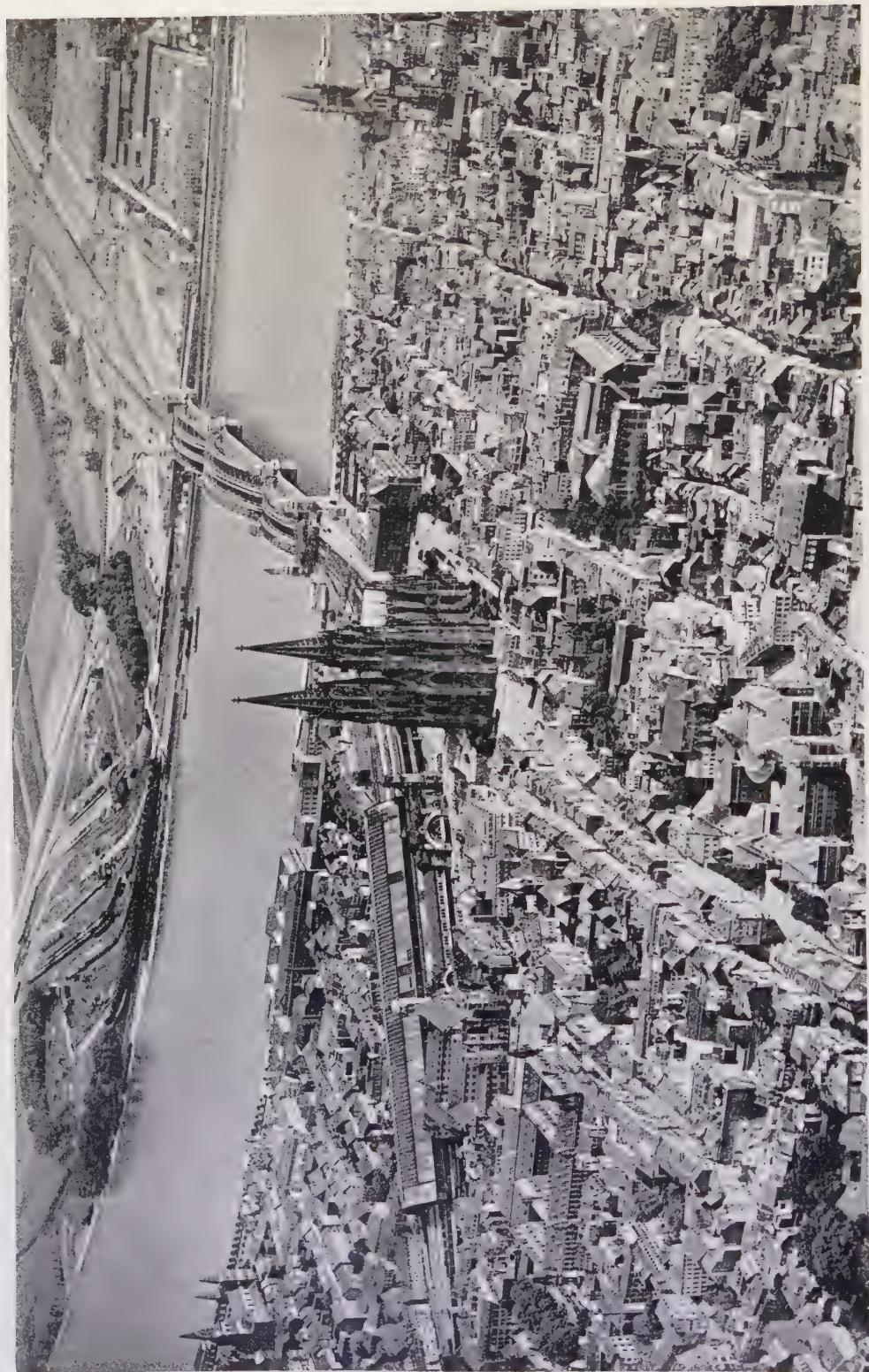
wander, antlike, through those great, dim spaces where groves of columns rise through an eternal twilight. Far overhead the outflung files of stained glass gleam like a belt of sparkling jewels, while higher still are panes which infiltrate a pale-blue light.

It is as if the cathedral's interior were meant to typify a dark world down into which the radiance of heaven is always shining from afar (see page 11).

Surprisingly, this masterpiece of Gothic architecture is in large part modern. It was begun in 1248 and languished for six centuries; then a fresh start was made in 1842. Legend relates that the original architect, Meister Gerhard von Rile, sold his soul to the Evil One, perished along with his plans, and continued to haunt the unfinished edifice until its completion, in 1863.

COLOGNE'S HISTORY GOES BACK TO ROMAN TIMES

"This is a voyage of discovery," my friend reminded me. "I'm not going to leave Cologne until I've found out whether the city was named after the



Photograph by Hermann Jansen

COLOGNE FROM THE AIR

The famous *Dom* overshadows this historic Rhine port, which was founded in 38 B. C. It is the center of the Rhenish trade and one of the most important commercial cities of Germany. To the left of the cathedral (see, also, page 10) is the Central Railway Station, and in the distance is the Hohenzollern Bridge. Deutz lies on the opposite bank of the Rhine.

perfume or the perfume after the city." So we unbared our ignorance to the local archivist.

He explained that Cologne originally meant "colony," or more specifically, Colonia Claudia Ara Agrippinensis, and that Rome had made it the administrative seat of her holdings in lower Germany. He even showed us a natural elevation, still discernible in the city's midst, where the Roman legions had once been encamped. Their general, Marcus Vipsanius Agrippa, started constructing for drainage and water-supply. That the work was quite up to standard may be proved by anyone who cares to inspect Cologne's underground tunnel, known as the Römerring.

As for the 77-kilometer conduit, the city's supply pipes follow the same line to-day.

After some four centuries of Roman occupation, the Germanic tribes threw off the yoke, and what had been known as the Colony gradually became known as Cologne.

By the Middle Ages it had become the home of ecclesiastical and lay art, and by the 14th century it had risen to a commercial prominence which has characterized the city down to to-day.

Modern Cologne is the port of registry for Rhine-to-the-sea traffic and the gateway of cargoes destined for North Sea ports, the Baltic, and the Neva.

Throughout Germany the civic authorities make monthly estimates of living costs. During our stay at Cologne the irreducible minimum for a family of four for the month of September, 1924, was computed at 168 gold marks, or about \$40. This represents an advance of 130 per cent over living costs in 1913.

BEETHOVEN'S DEATH MASK AND THE NEANDERTHAL SKULL

For a day my companion and I wandered about the quaint streets of near-by Bonn, in and out of its famous university, and along its Rhine esplanade. We separated for awhile, and when we met again my friend announced:

"There's only one important thing in Bonn. A musical student just now told me so. He said not to bother about the museum, but to see Beethoven's death mask."

"Yes," I countered, "according to an anthropologist I met in the university, there is only one important thing. He said not to bother about Beethoven's death mask, but to see the Neanderthal skull in the museum."

So we saw both.

The mask is enshrined in the little house where, in a mere garret whose door lintel is so low that one must stoop to enter, the great composer was born in 1770.

Among the adjacent Beethoviana you may see the tragic progression of ear trumpets, each one larger than the preceding, whereby the master sought in vain to circumvent deafness; the many manuscripts, including that of the "Moonlight Sonata," written in hastily jotted notes and headed by the direction, "With feeling," written in emotionally tremulous handwriting.

And there is the death mask—a face as noble as its brow is broad, a face stamped with human kindness, sad to the depths yet serene to the heights—an epitome of man's mental struggle upward.

Twenty minutes away, across the town, in a museum case environed by an exhibit of stone hatchets and spearheads, lay the skull of one of the earliest-known men, he of the Neander Thal, near Düsseldorf. In that big cranial expanse, protruding into heavy ridges at the brows, there is something almost terrifying. One imagines the complement of a semigorilla face, with bared teeth tearing at raw meat.

In twenty minutes we had spanned millenniums of human evolution, with all its mystery; for no craniological measurements could explain why the Neanderthal man's utmost invention was a flint weapon, while back of Beethoven's brow lay the "Moonlight Sonata."

That night we bade good-bye to Cologne's restaurant life and returned to the *Rijn-Schelde* and the captain's deck cooking.

Certainly his was the skimpiest kitchen outfit afloat. But we rather suspected madame of having hid most of the pots and pans, just to show him that getting along without a woman aboard wasn't so easy. Though smoked sausage, chilly coffee, and very plain cooking on *briquettes* comprised his efforts, he was be-



Photograph from Melville Chater

THE COLOGNE CATHEDRAL, THE FINEST GOTHIC EDIFICE IN GERMANY

The cornerstone of this architectural masterpiece was laid in 1248; its completion was celebrated in 1880. The twin towers are 515 feet high. The largest of the bells in the south tower weighs 27 tons, and formerly it took 28 bell-ringers to set it in motion.

ginning to chafe under domestic routine, especially whenever we delayed him by taking sponge baths from the bucket into which he peeled potatoes.

THREE BILLION TONS OF LIGNITE IN ONE SEAM

The briquette industry, by the way, we had "discovered" not far from Cologne. An imposing amount of lignite is machine-pressed into these handy fuel balls, the Rhineland's 72 lignite mines and coöperating plants having produced 7,000,000 tons of briquettes in 1923.

The presence of 60 per cent of water in German lignite and the impossibility of transporting without breakage hand-pressed fuel balls held back the industry until 1870, when the invention of a pressing-machine yielded cheap, firm briquettes of high heating power.

The great lignite seam southwest of Cologne measures 24 miles long by 3

miles broad, and contains, certainly, three billion tons. Throughout the Rhineland 24,000 men work in the lignite mines.

On leaving Cologne we had taken aboard two kayaks and their owners, a couple of young Germans who, with baggage strictly limited to a towel, a cake of soap, and two bottles of Rhine wine, proposed to ascend with us as far as Bingen, then paddle downstream.

Had we feared lest Rhine romance and legend had suffered eclipse in post-war Germany, the enthusiasm of those two youths would have reassured us.

LEGEND CLINGS LIKE IVY TO RHINE RUINS

At Rolandseck they sang a ballad at the remains of the castle where Roland died upon returning from the Crusades to find that his Hildegunde had entered a convent; and all along the winding stretch that leads to Coblenz they trolled the appropriate ballad as we breasted each ruin,



Photograph from Melville Chater

INTERIOR OF THE COLOGNE CATHEDRAL

"Far overhead the outflung files of stained glass gleam like a belt of sparkling jewels. . . . It is as if the cathedral's interior were meant to typify a dark world down into which the radiance of heaven is always shining from afar" (see text, page 7).

and cried out, "*Sehr schön!*" at every newly revealed vista.

Rhine legend is a good deal like the ivy that beautifies many a Rhine ruin, which, lacking the legend, would often be overlooked in favor of the river's ever-changing magnificence.

For a day the craggy heights continued, now lapsing horizonward, now re-assembling along the banks, as if in successive efforts to choke the Rhine. And, bend after bend, we sighted red-roofed, slope-set towns. Each had its neat quay, its water-side inn, an ideal route for motor car or motor boat, jealously guarded from the encroachment of factory chimneys and advertising signs.

A momentary flattening of the banks showed us Neuwied, the home of the Moravian Brothers' self-governing settlement and once the school town of George Meredith, who later novelized his German experiences in "Harry Richmond."

Then up shot the left-hand bank, culminating in the fortress of Ehrenbreitstein. Opposite, wedged in triangularly at the confluence of the Rhine and the Moselle, lay Coblenz (see illustrations, pages 14 and 15).

THE STARS AND STRIPES FLEW OVER AMERICAN FORCES AT EHRENBREITSTEIN

Confluentes, the Romans called the place. It has always been an important military stronghold, from the far-off days down to the occupation following the World War, when from early in December, 1918, to January 24, 1923, the Stars and Stripes flew from Ehrenbreitstein. The American forces, at their peak of strength, totaled 10,426 officers and 251,833 men.

We docked on the Moselle frontage near a flotilla of barges loaded with locally made sparkling wine. Then we



© Donald McLeish

THE FORTRESS OF EHRENBREITSTEIN, CALLED THE GIBRALTAR OF THE RHINE

This stronghold, across the Rhine from Coblenz (see page 11), crowns a knoll which rises to a height of 385 feet above the river. It occupies the site of a historic fort which played an important part in the Thirty Years' War. The Stars and Stripes flew from Ehrenbreitstein from December, 1918, to January, 1923 (see text, page 11).



Photograph from Ernest Peterffy

THE WOMAN WITH THE HOE PRESENTS NO SUCH FORLORN ASPECT AS THE MAN WITH THAT IMPLEMENT DEPICTED BY MILLET

The farms of the Rhine Valley have profited since the World War by the influx of such industrious young women.



FRENCH TROOPS PASSING OVER A BRIDGE AT COBLENZ, ON THE RHINE

found our way through some sleepy, old-world courtyards to the town's center.

In the doorway of a shop whose window displayed American cigarettes stood the proprietor, watching a review of French troops in an adjoining square. "No," we heard him mutter in accents unmistakably American, "taint like what it useter be."

He was, to use his own words, "the last American left in Coblenz," and signified his delight at meeting two fellow-countrymen by piloting us over the town. We strolled along the Rhine Promenade, across the interesting Bridge-of-Boats, up Ehrenbreitstein's steep cliff and down again. Now and then he would half-soliloquize, "No, Coblenz ain't like what it useter be."

He had come with the Army of Occupation, liked the town, had stayed on and married. The American troops had gone out and the French had taken their place.

At parting he forced upon us cartons and cartons of American cigarettes, and said: "If you ever get to Jonesville, see the folks an' tell 'em I'm O. K. Oh, Coblenz is all right, and the 'frawgs' are good customers of mine, but—" (his eye wistfully followed two *poilus* walking

with their girls) "well, you get me, 'tain't like what it useter be."

CHEERY LITTLE RHENS: "THE HANS SACHS TOWN"

Just beyond Coblenz we visited cheery little Rhens. With its single street of half-timbered house frontages painted over with drinking scenes, its carved gnomes and dogs upholding the door lintels, its swing signs announcing So-and-So, the "master builder" or "master tailor," Rhens seems less like a living town than like a stage setting for a market-place act of German opera.

In starched decorum, their fingers marking the place in their prayer books, Rhens' little population trooped past to church, inevitably suggesting an opera chorus. Two old men issued from under a swing sign marked "1600 A. D." to gossip across their long-stemmed pipes. They might well have been discussing some forthcoming song tourney, and a certain master cobbler who was likely to prove "meistersänger."

And so, in honor of Wagner's opera, we christened Rhens "the Hans Sachs town."

We rejoined the *Rijn-Schelde* at Co-



Photograph by Dr. Franz Stoedtner

BARGES AND RHINE STEAMERS AT COBLENZ

It was here that American troops were stationed after the World War. The last doughboy was not withdrawn until January 24, 1923.

blenz for another day's ascent of the river's magnificent, canyonlike course.

But Rhine folk do not permit perpendicular scenery to interfere with the business of grape-growing. From Bonn to Mainz we beheld an almost continuous vista of the vine—armies of grape-hung stakes rising on cliffs' flanks and in the valleys between—a riverside vineyard 90 miles long (see illustrations, pages 18, 23, and 25).

And plentiful as grape leaves were the Rhine legends rehearsed by our two fellow voyagers. That of the German knight who goes off to the Crusades, returning to find his ladylove dead, is the stock explanation for many a supposedly haunted Rhine castle.

THE LOCOMOTIVE'S WHISTLE HAS SUPPLANTED THE LORELEI'S SONG

The legend of Rheinfels, almost opposite the Lurlei (Lorelei), makes the departing knight plant a linden tree whose flourishing or decay would magically indicate the state of his health. In his absence a rival for his mistress' hand

secretly replaces the growing tree with a withered one, thereby causing the lady to commit suicide.

Passing the Lurlei, our fellow travelers burst into Heine's lines, "Ich weiss nicht was soll es bedeuten," while we two Americans speculated as to whether the nymph's siren song, to have reached mariners passing 430 feet below her cliff, had been transmitted by megaphone.

Poor Lorelei! Her song has been supplanted by the locomotive's shriek, and her classic rock has been tunneled by unholy railway engineers. But no trace of the Nibelungen hoard supposed to have been sunk there, according to the legend of the "Rheingold," has ever been found.

But these sacrileges are as nothing compared with the proposal of an American radio fan encountered at Mainz. He said:

"Why not capitalize the Lurlei's centuries of publicity by installing a broadcasting station on top of the rock? Vocal programs, of course, drinking songs advertising German wines, anvil choruses advertising German cutlery, cradle songs



SCHLOSS ELTZ, ONE OF THE BEST PRESERVED MEDIEVAL CASTLES IN EUROPE

This famous landmark, which dates back to the 12th century and has never suffered destruction or restoration, is situated on a lofty rock some 20 miles up the Moselle River from Coblenz. It is the ancestral home of the Counts of Eltz.



WHERE SIREN SONGS FORMERLY LURED SKIPPERS TO DESTRUCTION

On the right bank of the Rhine, a few miles south of Coblenz, rise the imposing rocks which, according to the fairy tale, were the dwelling place of the Lorelei (Lurlei), made famous by Heine's beautiful ballad (see text, page 15).

advertising German house furniture; and a big signboard on the front, running, 'Lorelei Broadcasting Company. Tune in on station LORE, to-night!'

Nearing Bingen we passed the little towns of Oberwesel and Bacharach, surely two of the quaintest old-world spots on the middle Rhine. Sleepily they regard their river reflections from behind 14th-century walls and towers, Oberwesel's tiny market place centered by a 12-foot cross bearing the effigy of Christ crucified, and Bacharach with its tradition of an effigy of quite another kind.

Supposedly the latter derives its name from Bacchus, and until very recent years

its natives continued the local custom of dressing up a straw man, throning it on a certain rock—some say it was originally a Bacchic altar—and singing around it.

HISTORY PUNCTURES THE LEGEND OF THE WICKED BISHOP EATEN BY RATS

Ahead, amid swift rapids, the remaining indications of long-impassable reefs blown up a century ago, rose the Mouse Tower (see page 23).

Having been brought up in the belief that the wicked grain profiteer of the 10th century, Bishop Hatto, was devoured here by rats, we were considerably dashed to learn from our fellow travelers that



Photograph from Ernest Peterffy

A SEMINARY ON WHEELS

These young German women are studying the science of farming. Perhaps they will eventually receive the degree of bachelormaid of agriculture.



Photograph by G. S. Urff

THE ORIGIN OF RHINE WINE

Young and old are gathering the grapes on a terraced hillside.



Photograph from Ernest Peterffy

A GOAT GIRL

In western and southwestern Germany, small estates and peasant proprietors predominate, while large estates are found chiefly to the northeast. According to the most recent livestock census, the Republic has more than 4,000,000 goats, a figure considerably in excess of the number of horses.

Musturm originally meant "arsenal," and not mouse tower, and that the tale of the bishop-eating rodents was first circulated four centuries after Hatto's death.

They made amends for our disappointment by recounting a legend of the Nahe River, whose confluence with the Rhine we breasted just outside of Bingen. The local count once bet Sir Boos of Waldeck a village that he couldn't quaff a hip boot filled with wine. Whereupon the latter quaffed the fill of both his boots and demanded the delivery of two villages.

"And now for Bingen!" said my friend anticipatively. It came in sight, a small-

ish, hill-set town, simple and sweet, in the evening glow (see pages 24 and 25).

"What, is *that* all?" he exclaimed in a defrauded tone. "Why, Bingen is world famous on account of that poem. I thought"—

Whatever he may have expected, I found the town's sweet intimacy just the right background for the ballad.

"A soldier of the Legion—dying at Algiers—lack of woman's nursing, dearth of woman's tears—for I was born at Bingen, at Bingen on the Rhine." These snatches of the classic recitation, delivered in German, came to us from one of our fellow voyagers.



Photograph by G. S. Urff

A FISHERMAN ON GUARD: WAITING FOR SALMON

The fisherman sits at an opening in his boat, holding the cords of the net in his hands. Experience has taught him to feel it immediately when a salmon, on rising in the stream, collides with the net. When this occurs he quickly pulls the cords from a lever, and poles tip over, drawing the net upward and catching the fish (see page 21).

Next morning our German friends paddled off in their canoes. A few hours later we were anchored near the broad esplanade at Mainz.

MAINZ NOURISHED FOLK BALLADS AND EARLY PRINTING EXPERIMENTS

The city is almost entirely modern, save for the cathedral and its surrounding market place, a scene which probably looks much as it did in the days of Mainz's two most distinguished citizens, Heinrich von Meissen, the poet, and Johann Gutenberg, the printer (see page 29).

Artistically speaking, von Meissen, popularly known as Frauenlob, was a descendant of the Minnesingers, just as these in turn were derived from the Provençal troubadours. Homage ballads of knights to fair ladies, expressions of the age of chivalry, were supplanted by ballads of the people when, in the 14th

century, Frauenlob founded the first school of Meister-singers.

A century after Frauenlob came Gutenberg with his printing press.

Our professional guide led us to the Gutenberg statue in Gutenberg Platz, and, clearing his throat, began: "Mainz is justly proud of being the cradle of the typographical art, which"—

"But look here!" put in my friend. "I was under the impression that it was at Frankfort that Gutenberg"—

"Not at all. There's the statue, *nicht wahr?*" returned the guide with an air of finality. So that settled it.

We visited the neighborhood of Gutenberg's alleged first printing office and studied specimens of his early work. We rehearsed the old legend how Gutenberg, to amuse his children, once cut some letters out of tree bark, and how the moist letters left imprints on the paper in which they were wrapped, this leading to his conception of type.

We envisaged his struggles, for he twice mortgaged his tools for loans wherewith to develop his invention; and we imagined the storm his press must have occasioned in the manuscript-copying trade, and the discouraging comments of "ingenious, but not commercially practicable," that possibly were circulating about the year 1440.

It must have been timidly enough that in 1447 Gutenberg made the first printer-publisher's guess at "what the public wants" by issuing an astronomical calendar for that year. A few years later



Photograph by G. S. Urff

SALMON FISHING ON THE RHINE

A 30-pound catch is being hauled aboard. Its furious struggles avail not, for strong fists kill it with a few blows on the head.

came his first important work—a Bible. Then his coworker, Johann Fust, drew out and set up his own printing establishment, apparently convinced that, notwithstanding the high cost of paper, there was a future in the business. ▲

THERE IS MORE LABOR THAN BEER IN A GERMAN LOGGER'S LIFE

Thanks to the *Rijn-Schelde's* cargo being in part for Frankfort, we had a day on the Main River, a day enlivened by the sight of huge, picturesque log rafts, each bearing a temporary shack, two raftsmen, and a keg of beer.

Floating downstream while trolling German ballads, with a pipe in one hand and a beer stein in the other, sounds more like a joy ride than an industry. As a matter of fact, logging bulks large among the enterprises of southwestern Germany, furnishing by far the greater part of sea-bound Rhine traffic; and there is more labor than beer in a logger's life.

In May-June and in October-November the lumberman is felling and barking trees among the Bavarian state forests in the

Fichtel Gebirge range. The stripped logs are linked end to end in groups of a dozen. At freshet time these units float down the creeks to artificially created ponds, where they are reassembled in groups of 60. Upon gaining the Main's affluents they are reformed into small floats.

As the stream widens, these floats are attached to each other, until at Bamberg they have become rafts of 600 logs apiece. Four days later, at Würzburg, each raft is augmented to 1,000 logs. Still lower down, the rafts are carefully reconstructed for their long river journey, and at Frankfort they are put under steam tow for Rhine towns and the Netherlands.

The sales have already been effected by auctioning off the logs at the upstream camps. As for the raftsmen, their joy ride begins at Frankfort, where the employer sends aboard each raft stipulated rations of bread, meat, and beer.

At Frankfort we decided to have a vacation from smoked sausage and cool coffee, so we waved an *au revoir* to the skipper—who by now was fuming ter-



Photograph from Ernest Peterffy

OFF FOR A DAY'S WORK IN THE FIELDS

ribly over the housework, or barge work, whichever one may call it—and found a hotel on the Kaiserstrasse.

Frankfort is a striking instance of a fine, modern city containing a perfectly preserved medieval *stadt*, or town.

The city's commercial importance, dating from the times when it was a Roman trading post, is reflected to-day in its two fine harbors, which handle annually from 8,000 to 9,000 boats from the lower Rhine and 7,000,000 tons of freight for transshipment (see page 30).

THE BIRTHPLACE OF GOETHE AT FRANKFORT

Park concerts, opera, café life, boulevard strolling—these reinforced one's

first impression of Frankfort as a center of gay modernity. Then, just off the beaten track, one discovers in Goethe's birthplace a quaint bit of the city's past.

A spacious and mightily dignified house it is, overlooking a staid rear garden and indicating that the poet sprang from a solid, well-to-do family.

Goethe Senior's room has a convenient corner window from which he could watch his son's comings and goings, while another room saw the budding author at work on his tale of lovesick Werther and "well-conducted" Charlotte, who simply "went on cutting bread and butter."

There, too, he launched early fragments of his "Faust."

If Frau Goethe ever had misgivings as



THE RHINE, THE MOUSE TOWER, AND THE RUINS OF EHRENFELS CASTLE,
OPPOSITE BINGEN

Recent research has proved that there is little foundation for the familiar legend that the wicked Bishop Hatto, the grain profiteer of his day, was eaten by rats in the Mouse Tower (see text, page 17).

to her son's chosen profession, she needed only to take her husband into the adjoining room, where stands the poet's puppet theater, and exclaim, "There! I told you that thing would put nonsensical ideas in our boy's head!"

A 10-minute walk from his house to the Römerberg would have yielded the poet all the needed local color for the market scene in "Faust." To this perfect example of a medieval mart, where 16th-century emperors were crowned while its fountain ran with red and white wine, and where Frankfort's renowned fairs were held for 600 years, one would need

to add only an orchestra and a peasant chorus in order to produce the kermis scene as it is played in Gounod's operatic version of Goethe's masterpiece.

The fountain running with wine is bettered in the poem by Mephistopheles' diabolical performance of making wine spring from auger-bored holes in a table.

Following the Faust trail from the Römerberg, one gains the near-by cathedral, recalling that Marguerite had just issued from confession when her future lover first accosted her.

Certainly it is difficult to stand within this 13th-century edifice, whose gemlike



Photograph by Wehrli A. G.

BINGEN, "A SMALLISH, HILL-SET TOWN, SIMPLE AND SWEET" (SEE TEXT, PAGE 19)

Caroline Norton's familiar poem is largely responsible for the fame of Bingen among English-speaking people. In the foreground is the seven-arched Drusus Bridge, across the Rhine, which flows into the Rhine at this point. It stands upon the foundations of a structure built by the Roman general, Nero Claudius Drusus (38-9 B. C.). On the skyline, appears a national monument which commemorates the founding of the German Empire in 1870-71.



BINGEN, WITH THE TERRACED VINEYARDS CLOTHING THE SLOPES OF THE NIEDERWALD ACROSS THE RHINE
In the distance, at the left, is the Mouse Tower (see, also, illustration, page 23). The small stream flowing into the Rhine is the Nahe.



OVERLOOKING THE RHINE FROM THE MEDIEVAL CASTLE OF RHEINSTEIN

The origin of this stronghold, a few miles from Bingen, is lost in tradition, but it began to figure in the history of the river as early as 1279 and became the residence of the Archbishop of Trèves in 1348.

windows spectrally illumine the surroundings, without imagining Goethe's heroine at prayer before the altar, while her Evil Spirit accuses her from the surrounding shadows.

Our local guide piloted us to a monument representing Johann Gutenberg and his coworkers (see page 29). Clearing his throat, he began: "Frankfort is justly proud of being the cradle of the typographical art, which"—

"But Mainz!" we protested, aghast. "Surely it was there that!"—

"Mainz! Pooh!" he returned. "Did those Mainzers really tell you that?" And he went on with his speech.

It was no easy matter for us mentally

to transfer Gutenberg, his press, and his struggles, from Mainz to Frankfort; but we did it and thanked the guide for putting us right.

CONFUSING ASPECTS OF TRAVEL IN GERMANY

We decided to make several towns by rail and rejoin the *Rijn-Schelde* at Strasbourg. So we paid our hotel bill—and an unusual travel experience it was to find that our room rent had been reduced in accordance with the city's latest price-revision list—then got our tickets and jumped on the train.

But ticket-booking for Germany's occupied zone wasn't as simple as it sounds.



THE RUINED CASTLE OF EHRENFELS

Across the Rhine from Bingen rises this 13th-century relic, amid terraced vineyards. At this point the valley of the Rhine contracts suddenly, and there was once a series of rapids here which proved an insuperable barrier to navigation. Not until 1900 was the work of blasting completed and the channel cleared of the dangerous reef.

First, we bought tickets to the zone border; then hurried to the "zone ticket-window," only to learn that marks were not accepted there. Then we rushed to the money-exchanging window, fled back again, and finally dashed out of the innumerable passenger cues to chase after the just-departing train.

Getting into our proper carriage proved equally difficult. To the complication of four classes, smoking and nonsmoking compartments, and those reserved for ladies, this militarized train added carriages "for officers only," and others "for subofficers only." In fact, our quest for

seats rather resembled the game of "Going to Jerusalem."

German railway stations commonly display large information signs, so large, in fact, as to be actually misleading if, like the two tourists who shared our carriage, one doesn't know the language. They were complaining bitterly of the German habit of naming different towns alike; they said they had certainly passed several way stations placarded with the same name, and that it was most confusing.

We did not understand this until we rediscovered them upon our arrival at Worms. They were standing inside the



Photograph by Emil P. Albrecht

THE OPEN-AIR MARKET OF MAINZ



Photograph by Melville Chater

ANOTHER VIEW OF THE MAINZ MARKET

The city is modern in aspect except for its cathedral and this market place. Its two most distinguished citizens were Heinrich von Meissen, the poet, and Johann Gutenberg, the printer (see, also, page 20).

station, under a big sign marked "*Ausgang*," and were looking for the exit!

"We were told to get off here for Worms," one of them explained hotly to an official, "and here we are at Ausgang! Where's the exit? If you Ausgang people would only put up information signs in your station!"——

"A u s g a n g n o t !
V o r - r m s i s s ! A u s g a n g
to outgo means!" responded the official with a self-control which was truly admirable.

THE STORY OF THE "NIBELUNGENLIED"

At Worms we had a bit of luck. We had visited the cathedral, whose site is associated with the "*Nibelungenlied*," and my friend was complaining of our romance-destroying century's disastrous effect upon such ancient cities. He said that he had come there to see the original headquarters of the Siegfried legend, and not business streets and wharfage, and that he thought he ought to get his money back.

Just then the 20th century came to our rescue in the form of a cinema house. "*Siegfried and the Nibelungen Treasure—Showing To-day!*" ran the poster. Two hours of a highly picturesque film, reproducing for us the ancient Burgundian court at Worms, together with Siegfried's exploits, made us realize that our century isn't so romance-destructive after all.

Next day we dropped in and out of Heidelberg for a taste of that delightful hill-surrounded, Neckar-bordering town.

Though during the World War its



THE GUTENBERG MONUMENT AT FRANKFORT-ON-THE-MAIN

For centuries there has been a bitter rivalry among several German cities over their respective claims to Johann Gutenberg, reputed father of printing. The most dependable authorities agree that he was born in Mainz, but that Strasbourg, Frankfort, and Venice share with his birthplace the honor of first practicing the art (see text, page 35).

famous university almost closed its doors, the student body now surpasses pre-war figures, with 3,100 registrations. Heidelberg's democratic tradition still speaks in the fact that needy would-be students are, upon investigation, exempted from tuition payments and may subsist in the university's dining hall at 16 cents a day.

HEIDELBERG'S STUDENTS FIGHT EIGHT DUELS A WEEK

Its educational tradition speaks in the provision that each state-paid professor lectures for but six hours weekly, so that



THE RIVER MAIN AND THE CITY OF FRANKFORT AS SEEN FROM THE SUBURBS OF SACHSENHAUSEN

While Frankfort is a thriving modern commercial city, it has managed to preserve its mediæval aspect in many quarters. Its history goes back to the days of Charlemagne.

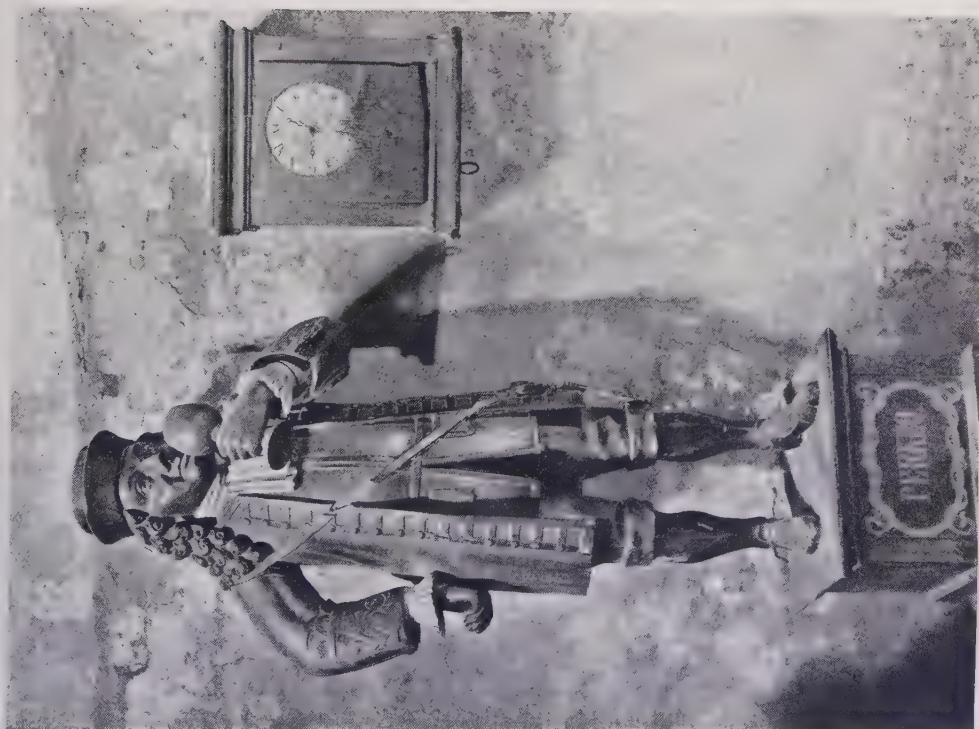
he may still further himself and the university by special research work.

Its fighting legend still flourishes in a minimum of eight duels a week, when padded and goggled fencers cross rapiers for the honor of their respective German states, and for the personal honor of receiving the coveted steel slash across their unprotected cheeks.

And, most picturesque survival of all, its tradition for escapades still lives in the university prison, where the incarcerated students, some of them subsequently generals in the World War, covered ceilings, walls, and windows with self-painted portraits, doggerel rhymes, and memorials of their scrapes.

"We had been hitting it up pretty hard on beer," confesses one of these memorials which we translated into colloquial language. "We swiped a vegetable cart and drove down High Street, soaking everyone with carrots and tomatoes. And now this dingy hole, with bread and water, is our reward for trying to put pep into Heidelberg!"

The original prison dates back to the 14th century. That university prison life is not what it used to be seems indicated in the local story of how the



STATUE OF PERKEO, A COURT JESTER OF THE 18TH CENTURY

This grotesque wooden figure stands in the cellar of the Heidelberg Castle, near the famous Heidelberg tun, a monster cask having a capacity of 49,000 gallons.



ONE OF THE RUINED TOWERS OF THE HEIDELBERG CASTLE

The remains of this majestic structure stand on the site of a castle erected at the beginning of the 13th century. Reduction to its present ruinous condition was due not to armies, but to a bolt of lightning in 1764.



Photograph by H. Parobin

THE OLD FRENCH QUARTER OF STRASBOURG

"Strasbourg is a plexus of waterways. The rivers Rhine, Meuse, Marne, Seine, and Rhone all contribute segments to a great circle of canals which has this city on its eastern circumference" (see text, page 34). In the distance, at the left, may be seen the spire of the cathedral rising to a height of 465 feet, which, with the single exception of the tower of the Rouen Cathedral, is the tallest in France.



Photograph from Melville Chater

A SHIPBUILDING YARD AT STRASBOURG, FRANCE

Strasbourg was a French city for more than two centuries, from 1648 to 1870, when it capitulated to the Germans after a siege of seven weeks. It was reoccupied by French troops in November, 1918, and was restored to the French people by the Treaty of Versailles (see text, page 34). Because of swift currents and the variation in the water levels beyond, this city is at the head of main navigation of the Rhine.



"ANYTHING FOR ME?"

A letter carrier of the Wolfach Valley, Black Forest region, and a peasant woman in her Sunday best. These costumes are worn only on Sundays, wedding days, and at funerals.

jailer was unable on one occasion to show some visitors through the cells "because," he explained, "the prisoners have gone off on a walking trip and have taken the keys with them."

FIVE GREAT RIVERS PAY TRIBUTE TO STRASBOURG

From Heidelberg we proceeded to Kehl, where we passed through the French customs, then crossed the Rhine, out of Germany and into Alsace-Lorraine.

Our stroll around Strasbourg revealed, in a kind of lagoon where three canals met, barges moving to and from such widespread points as Marseille, Paris,

and Amsterdam. In fact, Strasbourg is a plexus of waterways. The rivers Rhine, Meuse, Marne, Seine, and Rhône all contribute segments to a great circle of canals which has Strasbourg on its eastern circumference.

This ancient Celtic town still justifies, therefore, its historic name of Stratisburgum, or Town-on-the-Routes.

We arrived at the cathedral in time to see the noonday functioning of its curious astronomical clock, with its parading effigies of the Apostles, its crowing cock, its skeleton striker of the hours, its seven pagan deities symbolizing the days of the week—the whole suggesting the quaint conceits of German toymakers.

Rising like some ancient landmark between France and Germany, Strasbourg cathedral reveals, quite naturally, art influences of both countries. Its rich beauty

was evolved throughout some 250 years by master architects from several countries; and its abutting tower displays at a dizzy height the scratched names of many distinguished pilgrims, including Voltaire and Goethe, from both sides of the Rhine. In these several senses it might be called an international cathedral.

Strasbourg came into French hands for two centuries when, in 1648, Alsace was ceded to France in recompense for protection extended to the German Protestant princes. In 1870 the city capitulated to Germany after a seven weeks' siege. In November, 1918, it was reoccupied by French troops.



BOYS OF HASLACH, IN THE BLACK FOREST DISTRICT

In the remote valleys of the forest, especially in the southern section, the peasants still wear their national costumes on Sundays.

In reintegrating Alsace-Lorraine's 5,605 square miles and 2,000,000 people as the Departments of Moselle, Haut-Rhin, and Bas-Rhin, France's problem is to adapt the peculiar local and German laws to her own national code.

"BABYTOWN-ON-THE-RHINE"

Post-war Strasbourg contains an interesting experiment in the way of encouraging family life. Four-room bungalows, erected in a charming suburb, are rented to young couples at about 60 per cent less than the normal rate, the layout of houses and playgrounds being specially adapted for the upbringing of children. Indeed, the sole stipulation and social purpose are that the renting couples must be the parents of young children.

Possibly France, with her low birth-rate, casts an interested eye upon this experiment. And where more appropriately than at Strasbourg, the city of storks,

could have been inaugurated this little Babytown-on-the-Rhine?

The last thing our local guide showed us was a square in which rose a statue of our old friend, Johann Gutenberg (see text, pages 20 and 26).

"Strasbourg," he began, "is justly proud of being the cradle"——

But we interrupted him sternly. We told him about Mainz and Frankfort; we said that, as tradition-respecting Americans, we objected to having Gutenberg's cradle dragged about so promiscuously; and we commanded him to lead us to the nearest authority on the subject, which he did.

Our inquiry revealed that in past centuries there had been a terrific squabble among rival German towns over the possession of the Gutenberg tradition, a squabble entailing the forging of documents and the "discovery" of a bit of his original press four centuries after his



Photograph by Melville Chater

THE FERRY AT BASEL

The power employed in sending this little craft across the river is the current of the Rhine itself (see text, page 37).

death. It is certain that he was born at Mainz and there developed his invention, and that Strasbourg and Frankfort shared with that town and Venice the honor of first practicing the art.

Beyond this, the Gutenberg tradition is best likened to the mix-up of type known among printers as "pi."

FAMILY LIFE RESTORED ON THE BARGE

Learning that the *Rijn-Schelde* was due, we went down to the docks, arriving just in time to see a touching reunion.

On the quay stood the skipper's wife. She was excitedly waving her umbrella at the approaching barge, aboard which stood the skipper, who was as excitedly waving a frying pan at her. Their ensuing reunion on the dock appeared to be highly satisfactory to both.

It appeared that after a fortnight at Antwerp she had grown restless and had come on by rail to await the *Rijn-Schelde's* arrival. She said that 12 years of bargaining had ruined her for life ashore, and that she supposed she might just as well put up with the Rhine and its scenery, after all.

Then she fell to and cooked us a splendid dinner, thereby causing her delighted husband to announce that a womanless barge was almost as bad as engine trouble.

A few days later we waved them farewell, as the *Rijn-Schelde* headed downstream. Owing to low water, the skipper had transferred the balance of his cargo to a light-draft barge which, incidentally, would carry us two as far as Basel.

THE RHINE IS A TRICKY STREAM

Strasbourg, because of swift currents and the variance of water levels beyond that city, really constitutes the head of Rhine navigation. And the Rhine, as our skipper had never wearied of saying, is the trickiest stream that ever ruined a barge owner in a single season.

While normally it is 9 feet deep up to Mülheim, 6 feet at Bingen, and 4 feet near Strasbourg, the waters often drop or rise as much as 3 feet, and this in an incredibly short space of time, due to drought or to the melting of Alpine snows.

Such conditions, or perhaps floods on the upper stretches, may force a skipper

to transship cargo or discharge it prematurely; hence a Rhine bill of lading contains special protective clauses, such as "low-water supplements."

With the outskirts of the Black Forest on our left, our small group of steam-towed barges moved slowly upstream between the dikes, or walls, which here and there spoke of protection against the possibility of floods descending from the river's Alpine reaches.

Would it be advantageous to construct a 127-kilometer canal, paralleling the Rhine, between Strasbourg and Basel? The French think so, and the projected plans indicate a 60 per cent cut in transportation costs between the two cities. Swiss opinion prefers "the free Rhine" and its regularization by the creation of channels in the river bed.

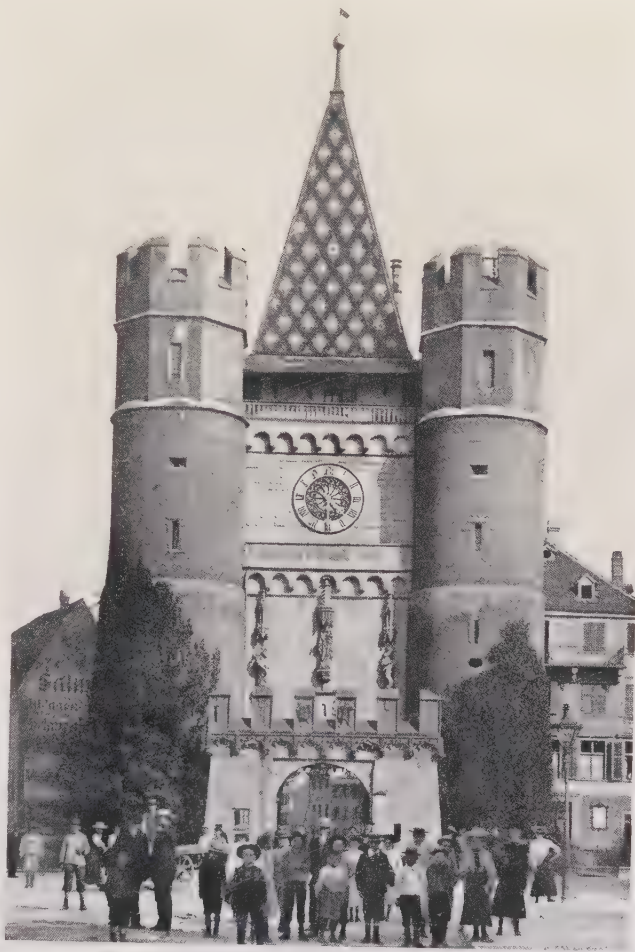
A FERRYBOAT WITH A
UNIQUE POWER
DEVICE

The Strasbourg-to-Basel section of the Rhine is open for about 200 days a year. The hard upstream pull is in part recompensed by the rapidity of the return trip, a fast-freight steam barge making Strasbourg in five hours, and reaching Rotterdam within three days.

The genius which turns obstacles into assets was certainly evident in the bank-to-bank ferryboat which we sighted on pulling into Basel. It functioned by transforming the swift current of 5 to 9 feet per second into a force which yielded the craft a lateral direction.

The outfit was simplicity itself: a telegraph wire, strung overhead from bank to bank, and a smallish boat pointed upstream, its bow connected by a line to two traveling wheels which ran along the wire (see page 36).

The steersman merely jammed his



Photograph from Melville Chater

THE SPALENTOR, BUILT IN 1400, FINEST OF THE OLD GATES OF BASEL

powerful rudder, so as to deflect the boat to a position slightly lateral to the head-on current. Immediately the side swipe of waters put it in motion, causing a drag on the telegraph wire; the traveling wheels began to move, and—hey, presto!—the launch sped across the Rhine to the opposite landing stage.

The return trip was effected by the steersman jamming his rudder in the reverse direction, thereby pointing his prow slightly toward the opposite bank.

The device, which was adopted 60 years ago from similar boats seen on the Moselle River, is in use at four of Basel's ferries. The spectacle of Father Rhine supplying mechanical force for crossing



Photograph by Wehrli A. G.

LAUFEN CASTLE, OVERLOOKING THE FALLS OF THE RHINE

This is one of the finest cataracts in Europe. The water descends in three leaps over a ledge of unequal height. Including the rapids, the fall is nearly 100 feet high. The falls are at their best in June and July, when the river is swollen by melting snow.

his own waters is typical of Switzerland, where man's resourcefulness has so splendidly conquered many of Nature's obstructions.

BASEL IS THE GATEWAY OF THE
UPPER RHINE

A stroll along Basel's tree-shaded river embankments shows three countries at a glance: Switzerland at one's feet, Germany's Black Forest across the Rhine, and France's outposts in the low Alsatian hills.

Basel is the gateway of the upper Rhine. Not water traffic, but Switzerland's "white coal," is mainly what lies between that gateway and Lake Constance, in the shape of four great hydroelectric stations. Compared with the economic value of what they draw from the river in the way of 180,000 horsepower, with twice that amount still awaiting development, the Nibelungs' fabled under-Rhine treasure pales into insignificance.

Railway power and factory power, cheap city lighting, and cheap propulsion of Basel's ribbon machines are among Father Rhine's local benefactions. Quite commonly in Swiss towns the house meter is obviated, and one burns light *ad libitum* on a flat annual rate of so much per bulb.

The ribbon machine is largely a home institution at Basel, where centers an industry producing annually from \$10,000,000 to \$15,000,000 worth of ribbons for export.

What with this, together with silk spinning and the production of coal-tar dyes, Basel has the enviable reputation of being one of the wealthiest cities of its size in Europe.

With the upper Rhine's stretch of more than 160 miles still before us, and early mists already giving their seasonal warning, we went on by train to Neuhausen, where, despite an impenetrable fog, my friend insisted on getting off to visit the Falls of the Rhine. I said that I had seen plenty of fogs, and that I would go on to Stein. He retorted that I was going to miss a magnificent spectacle, and I bet him 20 francs that he wouldn't be able to see anything of the falls (see page 38).

From Schaffhausen, that afternoon, the little steamer chugged its way up a narrow and sinuous Rhine, here and there

wildly wooded, with occasionally a brief stop at some sylvan townlet beside an old, covered bridge, with a glimpse of riverside laundrywomen, a snatch of passing gossip, and so on again.

And meanwhile, as it was obvious that the now-vanished fog must have ruined my friend's morning at the falls, I grew quite sympathetic over his having missed this intimate stretch of the Rhine and, incidentally, a matter of 20 francs.

THE FAIRY-TALE TOWN OF STEIN

Toward sunset there loomed up a castle-topped crag. At its foot was a river-fringing village with flower boxes begaying the windows, a gabled inn's waterside terrace, and a hop-skip-and-jump length of red, wooden bridge across the slender Rhine, which lost itself in distances where a gray church spire or two rose rapier-like against the sky.

Was I still in the 20th century, I wondered, or was I dreaming over some medieval romance? As I wandered through Stein's half-dozen unnamed streets, with their overhanging balconies and their house fronts painted with medieval tableaux, I felt that I should be bestriding a charger and accompanied by a largess-scattering squire (see page 41).

The house-front picture gallery included in its subjects a cardinal's reception, ladies being burned at the stake, Androcles and the lion, boar-hunting scenes, and—this was on a tavern—a representation of the pelican, with her brood sucking blood from her breast, the Gothic-letter caption reading: "Here you will be refreshed as generously as the pelican refreshes her young."

That night, having been candle-lit to bed, I pondered over Stein, the fairy-tale town, and its simple folk, so close to cities yet so unspoiled, until the Rhine under my window sang me to sleep.

Next day my friend turned up. He launched into eulogies upon the Falls of the Rhine, and annoyed me by being so sympathetic over my having missed them.

"Could you see anything of them at all?" I inquired suspiciously.

"See them?" he snorted. "Of course, I saw them, and you owe me 20 francs."

That afternoon a tourist whom he had picked up en route stopped me in the



Photograph from Ernest Peterffy

A GOOSEGIRL OF THE RHINE VALLEY

street. He said: "Some dare-devil, that friend of yours! Yesterday, at the Falls of the Rhine—it was so foggy you couldn't see your hand before your face—he got a rope and made the guide lower him over the bank and through the fog to the water's edge. He said that he wanted to be able to say that he'd *seen* the Falls of the Rhine."

Next day, while skirting Lake Constance on the way to Rorschach, through a world once more fog-muffled, my friend said, "We wouldn't be able to see anything of the lake on such a day as this. Let's go straight on by rail to Chur."

"Just the same," I replied, "I'll bet you 20 francs that I'll be able to see Lake Constance." He gave me a suspicious glance.

"Oh, I suppose there'd be some low trick about it," he answered with a virtuous air.

THE TOY PRINCIPALITY OF LIECHTENSTEIN VISIBLE FROM THE RHINE

Two hours beyond the head of the lake the fog's blinding gray suddenly melted, revealing in vivid greens a crystal-clear mountainland. The relief was so welcome, the sun-smitten air so tonic, that at

Sevelen we jumped off the train and started to walk. We reached the farther end of a wooden bridge which straddled a very shallow and pebbly stream, hardly recognizable as the Rhine.

Ahead rose a magnificent pine-clad mountain, castle-topped, its flanks clothed with the sleepest of old-world villages, through whose sole street great hay wains jogged and goosegirls drove their flocks.

"This is Vaduz, the capital of Liechtenstein," a passer-by informed us. "Yes, our prince allows travelers to visit the castle."

"Our prince," goosegirls, a village capital, and the principality's entire extent along the Rhine practically visible from where we stood! Small wonder that we felt like characters moving in one of the novelists' "toy-kingdom" romances.

To our undying regret the train schedule would not admit of our encompassing little Liechtenstein, with its 65 square miles and 10,000 inhabitants, or of visiting the château of Prince Johann II. And though we were really keen, for the first and only time in our lives, to go through the customs examination, we were robbed of even this experience by the fact that Liechtenstein's customs, postal, and telegraph services are arranged through the Swiss Government.

An hour later the railway brought us to Chur. Thence, by an electrified, narrow-gauge line, we climbed onward toward Disentis, rising 16 feet a minute along the rim of a twisting gorge, at whose bottom the slim, swift Vorder



Photograph from Melville Chater

STEIN-AM-RHEIN, SWITZERLAND

"As I wandered through Stein's half-dozen unnamed streets, with their overhanging balconies and their house fronts painted with medieval tableaux, I felt that I should be bestriding a charger and accompanied by a largess-scattering squire" (see text, page 39).

Rhine, fresh from its source among Alpine snows, ran gray green over a semi-arid bed.

Still the green, scarlet-flecked mountains lifted, lifted, lifted, with shrill rivulets rushing down them to add their little to the slow making of a great river. And at last came the snow, blindingly white, on sheer rock profiles that cut with razor-like sharpness the upper sky. And, though the peasants were already carting their winter forage and stacking their winter logs, a hot sunshine deluged the river's wooded ravine, from which rose to us earthy breaths as of spring.



Photograph by Carl Lutz

A HERD OF GOATS: DISENTIS (SEE TEXT BELOW)

At twilight the distant snow peaks went rosy in the wake of a sunken sun. Sleepy bell-tinklings came from homeward-driven flocks, as we left the train at Disentis, a hill-slanting village brooded over by a white, sky-shouldering alp.

"You'll make Andermatt to-morrow," the host at our humble inn informed us. "That is, unless we're snowed in overnight. The postal wagons quit weeks ago, and any morning we may wake up to find all local communications closed till next spring. You're about a month out of season."

It wasn't encouraging. We went to bed feeling like the last rose of summer faced by a blizzard forecast.

THE SNOW CRADLE OF THE INFANT RHINE

Sheer apprehension woke us at sunrise. Luck had played on our side. By 8 o'clock we were afoot on the still snowless road to Andermatt, intermittently shivering or thawing out as the mountainous route rose into sunny heights or dropped into valleys still dark in early dawn.

At last the sun cleared the highest of the surrounding Alps and we beheld,

crowning a world that might be snow-bound to-morrow, the outstretched brilliance as of a perfect summer's day.

Our 15-mile hike edged upon a dizzy gorge where, between the pines' spearlike ranks, rushed the turbulent Vorder Rhine, now laving some farm-dotted valley, and at last pointing us straight at an enormous alp, rising miles away like some impassable snow wall across the world.

Everywhere sounds of running water haunted us, coming from countless rills on their headlong way down into the gorge, and once, when we crossed a green meadow, it proved morasslike with its hidden springs. The whole region was contributing its moisture to the beginnings of the Rhine.

Trite but true is the simile that likens man's life to the course of a river. Both have their cradle, their season of boisterous play, their gradual broadening and sobering for the ends of commerce and service. For six weeks we had followed Father Rhine's more than 600 miles of varied life, until now he was a mere infant of the Alps, fed on melted snows.



Photograph by Ad Astra-Aëro

AN AIRPLANE VIEW OF ANDERMATT

The white ribbon which meanders up the mountain slope is the road leading to the Oberalp Pass, 2,000 feet above the Swiss town.

Under the sky's burning blue, with butterflies hovering over daisies along a roadside a-shimmer with warmth, we toiled upward by zigzag ways along the base of that great snow mountain, the Badus, to where, at 6,720 feet, we gained the summit of the Oberalp Pass.

A few miles beyond and 2,000 feet below the pass lay a great green valley, the Urseren Thal, centered by what resembled at our altitude a cluster of bird houses. It was the town of Andermatt (see above). And at the Urseren Thal's opposite end rose another great snow mountain, facing the Badus at our end of the valley.

Surely we felt that we were standing on the top of Europe; for we knew that from the mountain beyond the Urseren Thal the beginnings of the Rhône were descending, to swell southward to the Mediterranean; and, rising out of a little green lake on the farther shoulder of the Badus, was the glistening thread that we now beheld dropping into the Vorder Rhine's chasm, on its long journey to the North Sea.

"Listen!"

Through the intense stillness there came to us the faint, shrill sound of rushing water. It was singing to itself in its snow cradle—the infant Rhine!



PAGES FROM THE FLORAL LIFE OF AMERICA

THE 24 color plates, representing 55 flower paintings, appearing in this number of the NATIONAL GEOGRAPHIC MAGAZINE, are from the brush of Miss Mary E. Eaton, whose work has brought so much pleasure to members of the National Geographic Society during the past decade. They are reproduced from The Society's "The Book of Wild Flowers,"* recently published, and are printed in the MAGAZINE

HAIRY RUELLIA

Ruellia ciliosa Pursh Acanthus Family
[Plate I, left]

The hairy ruellia flourishes in dry soils from New Jersey to Nebraska and southward to the Gulf of Mexico. It is a hardy perennial, blossoming from June to September. In addition to its fine, showy flowers, it has small cleistogamous ones that look like unopened buds. Some of the carpenter-bees have been seen biting circular pieces out of the corolla and carrying them away to plug up cells in the tunnels they excavate in soft wood as nesting galleries.

WESTERN SPIDERLILY

Hymenocallis occidentalis (Le Conte)
Kunth Amaryllis Family [Plate I, middle]

The spiderlily, with its long stamens and its peculiarly placed anthers, looks like the daddy longlegs of the flower world. The species that come into our territory are few. They are mostly tall, bulbous herbs, and, like their tropical cousins, are exclusively American. They get their genus name from the Greek, the term signifying "beautiful membrane" and referring to their strikingly handsome crowns. The spiderlilies flower in late summer.

GOLDENCLUB

Orontium aquaticum L. Arum Family
[Plate I, right]

The goldenclub has a range that reaches from New England to the Gulf of Mexico, and is usually found in shallow ponds, standing water, and swamps. The sight of a large mass of these flowers is one not soon to be forgotten. The species lacks the spathe characteristic of the beautiful white robe of the calla lily, or the bright green of the "pulpit" of its other cousin, Jack-in-the-pulpit; but this is because it has cast off its formal clothes and appears only in

*THE BOOK OF WILD FLOWERS, describing 250 species of wild flowers and familiar grasses, representing 114 families, with 128 pages in full color. Art binding in brown, bronze, and gold. \$4, postpaid. Obtainable only from National Geographic Society, Washington, D. C.

in order that those who have saved their back numbers may have a complete collection of Miss Eaton's published paintings.

The flowers represented in this number belong to 49 different families and, together with those previously published, make a representative cross-section of the floral life of America. (For more detailed biographies, see "The Book of Wild Flowers.")

its bathing suit when it commands our attention. Like the sweetflag, the goldenclub, inhabiting watery ground, has to rely mainly on gnats and other minute insects as its intermediaries in the process of fertilization, and has, therefore, arranged its flowers in large masses of very small individuals, which are readily fertilized by these insects walking about over them.

COMMON AMARANTH

Amaranthus hybridus L. Amaranth Family
[Plate II, left]

The common amaranth, like the black-eyed-susan, seems to offer a reversal of the usual course of weeds, for it appears to have come eastward instead of going westward. It gets its name from a Greek term meaning "unfading," in recognition of the fact that its flowers retain their color when dry. It blossoms from July to October, and is abundant in both cultivated and abandoned ground. A native of the Southwest, it not only has pushed its way eastward, but has also spread northward and has become a widely dispersed weed, with a vast territory under colonization. Its most familiar name to laymen is probably pigweed. One variety of this species is cultivated as a flower in many gardens.

PEARL EVERLASTING

Anaphalis margaritacea (L.) Benth. & Hook.
Aster Family [Plate II, right]

With a range that reaches from the Atlantic to the Pacific and far into Canada, the pearl everlasting possesses many local aliases, such as silver-leaf, moonshine, none-so-pretty, lady-never-fade, ladies'-tobacco, and silver-button. An adventive from Europe, it has spread until it has added even Alaska to its empire. Furthermore, it has ventured as far south as North Carolina. Dry fields and open woods constitute the environment in which the pearl everlasting thrives best, and July to September, the season in which it puts forth its flowers.

For fertilization it is entirely dependent on its insect guests. It bears male and female florets on separate heads, although on the same plant, so that it must cater to its patrons. The female florets have tubular, five-cleft corollas, two-cleft styles, and a large number of hairy

bristles. The male florets are more slender. The nectar of the pearl everlasting is protected from pilfering ants by a cottony substance on the wiry stem of the plant. It is next to impossible for the ants to travel through this fluffy defense.

DOWNY HAWTHORN

Crataegus mollis (T. & G.) Scheele Apple Family [Plate III, left]

When Missouri came to adopt a State flower the legislature was guided by the recommendations of the Daughters of the American Revolution of that State. The agitation of the subject began following the publication of the article on State Flowers in the NATIONAL GEOGRAPHIC MAGAZINE in 1917. The daisy was at first recommended by a vote of the conference of the Daughters in 1919, but the following day a motion to rescind that action, because the daisy was not a native and was the emblem of other States, was passed. A glowing tribute to the red haw as a native flower whose berries were prized by the pioneers for making jellies and whose wood served them as material for shuttles used in weaving homespun resulted in the adoption of that flower and a recommendation that the legislature accept it.

This was done in 1923, and the act specifies *Crataegus* as the genus. This group contains perhaps a score or more of species indigenous to Missouri, but the Daughters of the American Revolution generally favor *C. mollis* or *C. crus-galli*—respectively the downy hawthorn and the cockspur thorn in poplar nomenclature, both being included in the term "red haw" as used by laymen.

It is said that more birds nest in the dense foliage of the Missouri hawthorns than in all other native trees, and that the red cardinal and the brown thrasher particularly prefer it. The school children use the hawthorn blossoms to decorate their school rooms in the spring and the berries in the fall.

BEGGAR-TICKS

Bidens frondosa L. Aster Family [Plate III, right]

This beggar-ticks is one of a group of about 75 species of wide distribution whose seeds have hooked teeth for stealing transportation from passing creatures. The genus includes the bur-marigolds and the tickseed-sunflowers.

Bidens frondosa is found in moist soils from Nova Scotia to Florida and from British Columbia to California and Texas. It has also gone across the seas to repay Europe in part in her own coin for weeds sent to America.

This species of beggar-ticks is variously known as the rayless marigold, cuckles, old-ladies clothes-pins, beggar-lice, etc. Its blossoming time is from July to October.

SKUNKCABBAGE

Spathyema foetida (L.) Raf. Arum Family [Plate IV]

This evil-smelling, insect-baiting relative of the proud calla lily and the savory sweetflag

lives in swamps and wet ground over a territory that reaches from the Atlantic seaboard to and beyond the Mississippi River and from Nova Scotia to the Gulf of Mexico. Its flowering season is from February to April, and whoever invades its precincts about that time is likely to debate with himself whether it is the odor of putrid meats, cooking garlic, or aroused skunk that assails his nostrils.

The skunkcabbage has a habit of appearing too early in the season to be served by the bees and butterflies. Only the flesh flies are then on the wing. And so the unsavory odor that disgusts us and delights them is prepared and set out in vegetable tissue that has the guise as well as the odor of decaying meat.

The spiders have learned that the flesh flies congregate in the skunkcabbage's pantry, and they build webs galore over the entrances to the spathes, so as to trap them the more readily.

So, also, some Nature fairy whispered into the ear of some of the swamp-dwelling birds that their nests would be safe in the hollow of the skunkcabbages, and the lizards got word by grapevine telegraph that their enemies would stay away if they dwelt beneath the skunkcabbage. Cattle and sheep have been taught alike by its bad odor and its acrid juices to give the foetid plant a wide berth.

BEECHDROPS

Leptamnium virginianum (L.) Raf. Broomrape Family [Plate V, left]

Beechdrops grow from six inches to two feet high and are found in beech woods from Nova Scotia to Florida and from Ontario to Louisiana. They are sometimes called cancer-root, cancer-drops or Virginia brown-rape. They are parasitic plants with the common characteristics of the broom-rape family. The plant preys mainly on the roots of the beeches, another instance of striking specialization. It flowers from August to October.

VIPERS-BUGLOSS

Echium vulgare L. Borage Family [Plate V, right]

This species is a large biennial, native of Europe, growing in dry places, particularly in cornfields, where it often becomes a troublesome weed. Its range is from Nova Scotia to Ontario, and southward to North Carolina and Nebraska, where its flowering season runs through June and July. The flowers are at first pink or reddish, later changing to blue. The spots on the stems resemble somewhat those on the viper, and our forefathers concluded therefore that it had the property of healing vipers' bites. Hence its name.

GLOSSY BUCKTHORN

Rhamnus frangula L. Buckthorn Family [Plate VI, left]

The glossy buckthorn, found in bogs in sections of the North Atlantic Coast States, and sometimes known as the black dogwood, has

been naturalized from Europe. It is also known in some localities as berry-alder and Persian-berry. The shrub bears its flowers in May and June and its fruit ahead of the frost.

DEVILSBIT

Chamaelirium obovale Small Bunchflower Family [Plate VI, right]

This flower is found in moist meadows from southern Canada to Florida and Arkansas, and sometimes travels under such names as blazing-star, unicorn-root, unicorn-horn, drooping starwort, and false unicorn-plant. It flowers in May, June, and July.

ARROWLEAF TEAR-THUMB

Tracaulon sagittatum (L.) Small Buckwheat Family [Plate VII, left]

This species lives in wet soil from Newfoundland to Florida and westward to British Columbia and Kansas. Its flowering season is from July to September. It is a climber, sprawling over other plants to find its place in the sun. Its prickles are rather more savage than those of halberdleaf tear-thumb, of the same range. One who has had experience with these prickles feels that there was more truth than poetry in the mind of the man who gave it the English name it bears.

SPIDERFLOWER

Cleome spinosa L. Caper Family [Plate VII, right]

The spiderflower, sometimes passing under the name of prickly cleome, is a native of the Tropics, brought here to grace our gardens. After escaping from human pampering to the open spaces, it established an independent existence. It has been able to brave the frosts as far north as southern New York and Illinois, and prefers waste places for its habitat.

RATTLESNAKE-ROOT

Prenanthes alba L. Chicory Family [Plate VIII, left]

This species occurs in Canada and the northern part of the United States as far west as the Rocky Mountains. Joy-leaf, cancer-weed, lion's-foot, and wild lettuce are some of its local names. Its flowering season occurs in August and September. Rich woods, thickets, and heavily shaded ground generally are its favorite haunts.

ORANGE HAWKWEED

Hieracium aurantiacum L. Chicory Family [Plate VIII, right]

The orange hawkweed comes from Europe. It has established itself over a range reaching from New Brunswick to Ontario and southward to Pennsylvania, and is variously known

as the tawny hawkweed, the golden mouse-ear hawkweed, grim-the-collier, Flora's-paint-brush, and red daisy. Its flowering season begins with June and ends with September.

ZIGZAG BLADDERWORT

Utricularia macrorhiza Le Conte Bladderwort Family [Plate IX, left]

This bladderwort is found in stagnant water or sluggish streams from Newfoundland to Alaska and southward to Maryland and southern California. Its flowering season is from May to August. The bladders are found on submerged branches and are modified leaves. Leading into each bladder is a door which opens inward but not outward. The creeping insect finds ingress easy and inviting, but escape impossible. The products of its decomposition are absorbed by cross-shaped cells lining the inner surface of the bladder.

PYXIE

Pyxidanthera barbulata Michx. Diapensia Family [Plate IX, middle]

In some sections putting forth its flowers even ahead of the trailing-arbutus, the pyxie is always an early harbinger of spring. The habitat of this plant is generally sandy pine woods, and its range is from New Jersey southward. The genus name comes from two Greek words, the one meaning small box, and the other, anther, and tells us that the anthers of the pyxie are little boxes with lid-like openings.

DANDELION

Leontodon taraxacum L. Chicory Family [Plate IX, right]

Our common dandelion gets its name from the corruption of the French phrase, *dent de lion*, applied to the flower by the Gallic imagination that was able to see, somewhere in its shape, resemblance to a lion's tooth. It is found in fields and waste places in nearly every civilized country, reaching America from Europe only a little later than the first colonists. It yields a milky juice, which in the form of an extract has diuretic and alterative properties.

Its precocious springtime habits, its excellence as greens with a tonic effect, the fun the children have with its stems and puffball heads, tend to excuse it for its intrusion in our lawns, and make it one of the most widely known of all plants.

FLOWERING DOGWOOD

Cornus florida L. Dogwood Family [Plate X]

When Virginia's legislature came to consider the choice of a State flower, a great many people wanted the Virginia creeper—a flower whose very name, wherever it is found, proclaims the Old Dominion. But someone suggested that Virginians were not climbers and



HAIRY RUE
Ruellia ciliosa Pursh
ACANTHUS FAMILY



WESTERN SPIDERLILY
Hymenocallis occidentalis (Le Conte) Kunth
AMARYLLIS FAMILY



GOLDENCLUB
Orontium aquilegifolium L.
ARUM FAMILY



© N. G. S.

COMMON AMARANTH
Amaranthus hybridus L.
AMARANTH FAMILY

PEARL EVERLASTING
Anaphalis margaritacea (L.) Benth. & Hook.
ASTER FAMILY



DOWNY HAWTHORN
Crataegus mollis (T. & G.) Scheele
 APPLE FAMILY
 Missouri State Flower



BEGGAR-TICKS
Bidens frondosa L.
 ASTER FAMILY



© N. G. S.

SKUNKCABBAGE
Spathyema foetida (L.) Raf.
ARUM FAMILY



© N. G. S. **BEECHDROPS**
Leptamnium virginianum (L.) Raf.
BROOM-RAPE FAMILY



VIPERS-BUGLOSS
Echium vulgare L.
BORAGE FAMILY



GLOSSY BUCKTHORN
Rhamnus frangula L.
BUCKTHORN FAMILY



DEVIL'S-BIT
Chamaelirium luteolum
BUNCHFLOWER FAMILY



SPIDERFLOWER
Cleome spinosa L.
CAPER FAMILY



ARROWLEAF TEAR-THUMB
Tracaulon sagittatum (L.) Small
BUCKWHEAT FAMILY

© N. G. S.

ORANGE HAWKWEED
Hieracium aurantiacum L.
CHICORY FAMILY



RATTLE-NAKE-ROOT
Prenanthes alba L.
CHICORY FAMILY





DANDELION
Leontodon taraxacum L.
CHICORY FAMILY



PYXIE
Pyxidanthera barbata Michx.
DIAPENSIA FAMILY



ZIGZAG BLADDERWORT
Utricularia macrorhiza Le Conte
BLADDERWORT FAMILY

© N. G. S.



© N. G. S.

FLOWERING DOGWOOD
Cornus florida L.
Dogwood Family
Virginia State Flower



COMMON SUNDROPS
Oenothera fruticosa L.
EVENING-PRIMROSE FAMILY



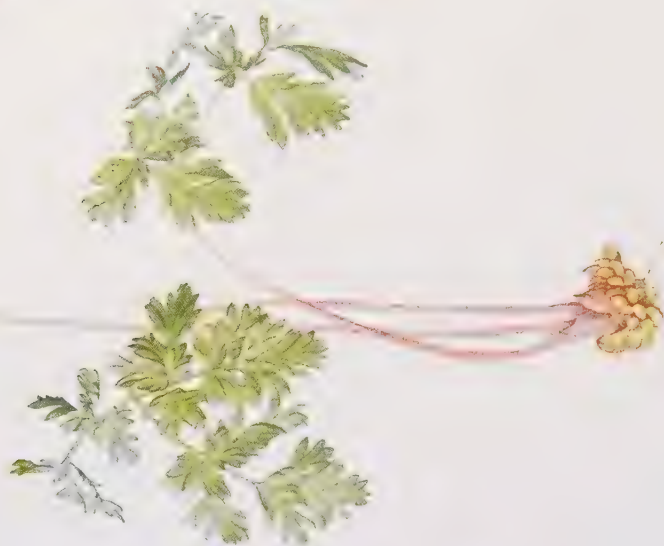
INDIAN PAINTBRUSH
Castilleja coccinea (L.) Spence.
FICARDO FAMILY



HOLMS GERARDIA
Erodium cicutarium Pers.
FICARDO FAMILY



© N. G. S. HEARTLEAF UMBRELLA-WORT
Allionia nycaginea Michx.
 FOUR O'CLOCK FAMILY



DUTCHMAN'S-BREECHES
Dicentra cucullaria Bernh.
 FUMITORY FAMILY



ROSEGENTIAN
Sabatia angularis (L.) Pursh
 GENTIAN FAMILY



WAX CURRANT
Ribes cereum Douglas
 GOOSEBERRY FAMILY



DWARF GINSENG
Panax trifolium L.
 GINSENG FAMILY

© N. G. S.



MOCK CUCUMBER
Echinocystis lobata T. & G.
 GOURD FAMILY



LAMBS-QUARTERS
Chenopodium album L.
 GOOSEFOOT FAMILY

© N. G. S.



FLAME, AZALEA
Asalea lutea L.
 HEATH FAMILY

RED PINESAP
Hypopitys insignata B.S.P.
 INDIANTIFE FAMILY

HORSETAIL
Equisetum arvense L.
HORSETAIL FAMILY



ROSEBAY RHODODENDRON
Rhododendron maximum L.
HEATH FAMILY
West Virginia State Flower



CAROLINA-JESSAMINE
Gelsemium sempervirens (L.) Ait. f.
LOGANIA FAMILY
South Carolina State Flower





© N. G. S.

PURPLE TRILLIUM
Trillium erectum L.
LILY-OF-THE-VALLEY FAMILY



BLUEBELLS
Houstonia caerulea L.
MADDER FAMILY



COMMON MEADOWBEAUTY
Rhexia virginica L.
MEADOWBEAUTY FAMILY



© N. G. S.

TULIPTREE (Upper)
Liriodendron tulipifera L.
MAGNOLIA FAMILY
Indiana State Flower

FRINGED POLYGALA (Lower)
Polygala paucifolia Willd.
MILKWORT FAMILY



© N. G. S. **FOURLEAF MILKWEED**
Asclepias quadrifolia Jacq.
 MILKWEED FAMILY



COMMON LILAC
Syringa vulgaris L.
 OLIVE FAMILY
 New Hampshire State Flower



SENSITIVE PLANT
Mimosa pudica L.
 MIMOSA FAMILY



COMMON CARROT
Daucus carota L.
PARSLEY FAMILY



COMMON HOP
Humulus lupulus L.
NETTLE FAMILY

© N. G. S.



MAYPOP
Passiflora incarnata L.
 PASSIFLOWER FAMILY
 Tennessee State Flower



HOARY TICKCLOVER
Desmodium canescens DC.
 PEA FAMILY



GREAT RAGWEED
Ambrosia trifida L.
RAGWEED FAMILY



NUTTALLS PONDWEED
Potamogeton ephedraceus Raf.
PONDWEED FAMILY



RUGELS PLANTAIN
Plantago rugelii Dreue.
PLANTAIN FAMILY

© N. G. S.



PARTRIDGE PEA

Chamaecrista fasciculata (Michx.) Greene
 LEGUMINOSAE FAMILY

CORAL BELLS

Heuchera sanguinea Engelm.
 SAXIFRAGE FAMILY

COMMON WOODRUSH

Galium aparine L.
 RUSH FAMILY



VENUS FLYTRAP
Dionaea muscipula Ellis
SUNDEW FAMILY



AMERICAN LOTUS
Nelumbo lutea (Willd.) Pers.
WATERLILY FAMILY

the Virginia creeper was, and in the deadlock that followed the advocates of the dogwood offered it as a compromise candidate. As it was the second choice of almost everybody, it finally was unanimously chosen. It flourishes from Maine to Florida, and from Ontario to Texas, ascending to the very summit of Virginia's highest mountains. Its blossoms are beautifully white in the spring and its leaves brilliantly red in the autumn. The flowering season runs from April to June.

COMMON SUNDROPS

Oenothera fruticosa L. Evening-primrose Family [Plate XI, left]

This species of the evening-primrose family, called by Britton and Brown *Kneiffia alleni*, by the National Herbarium *Kneiffia fruticosa*, has a wide distribution in the eastern United States, blooming from late May to late August. It is the ancestor, according to Standardized Plant Names, of the cultivated sundrops known as bush sundrops and Young's sundrops. It is a day-blooming species, although belonging to an evening- and night-blooming family, and a field of sundrops is a sight not to be forgotten. They may be kept fresh in vases for a full week.

INDIAN PAINTBRUSH

Castilleja coccinea (L.) Spreng. Figwort Family [Plate XI, middle]

Flourishing in meadows and moist thickets from Maine, Ontario, and Manitoba to North Carolina and Texas, blooming from May to July, and wearing such neighborhood names as red Indians, wickawee, election-posies, bloody-warrior, and nose-bleed, the Indian paintbrush justifies Thoreau's remark that it reminded him of a flame. "It is startling to see a leaf thus brilliantly painted, as if its tip were dipped into some scarlet tincture, surpassing most flowers in intensity of color," he added.

HOLMS GERARDIA

Agalinis holmiana (Greene) Pennell Figwort Family [Plate XI, right]

This is one of a dozen or more species of purple foxgloves found in the United States. It frequents pine barrens, dry woods, and open fields from New Jersey and Florida westward to Texas, and has a blooming period that begins in August and runs to October. It is an annual and grows from one to two feet tall.

HEARTLEAF UMBRELLA-WORT

Allionia nyctaginea Michx. Four-o'clock Family [Plate XII, left]

This umbrella-wort flourishes in dry soil from Manitoba southward to Louisiana and Texas, and as far west as Colorado. It has followed the black-eyed-susan eastward and

has reached the environs of Washington, D. C. Growing from one to three feet tall, it puts forth its flowers from May to August, inclusive.

DUTCHMANS-BREECHES

Dicentra cucullaria Bernh. Fumitory Family [Plate XII, middle]

The Dutchmans-breeches gets its English name from its close resemblance to the conventional balloon-legged trousers of the Hollander. Blossoming in April and May, over a range that reaches from Nova Scotia and Minnesota to North Carolina and Kansas, its feathery leaves and delicate, odd-shaped flowers are always attractive. The bumblebees and long-tongued butterflies are its favorite guests, as short-tongued insects cannot sound the depths of its nectar cups.

ROSEGENTIAN

Sabatia angularis (L.) Pursh Gentian Family [Plate XII, right]

This species of gentian occurs in rich soil and thickets over a range that extends from New York to Florida and from western Ontario to Oklahoma and Louisiana. Its flowering time is in July and August. Some of its vernacular names are bitter-bloom, rose-pink, bitter clover, pink-bloom, and American centaury.

DWARF GINSENG

Panax trifolium L. Ginseng Family [Plate XIII, left]

The dwarf ginseng dwells in moist woods and thickets over a range that reaches from Nova Scotia and Ontario and from Georgia to Iowa. Its flowering season runs from April to June. It has a warm aromatic taste and boys roaming the woods like to chew its roots.

WAX CURRANT

Ribes cereum Douglas Gooseberry Family [Plate XIII, right]

This beautiful member of the gooseberry family is one of the many species of currants, and is a close relative of the white-flowered currant, for which it is sometimes mistaken. It is without prickles and its fruit is insipid.

LAMBS-QUARTERS

Chenopodium album L. Goosefoot Family [Plate XIV, left]

This member of the goosefoot family is also known as pigweed, white goosefoot, wild spinach, frost-blite, baconweed, muckweed, and fat-hen. It is an extremely common weed throughout North America except in northern Canada, and blooms from June to September. Its succulence makes it a favorite of hogs living in pens.

MOCK-CUCUMBER

Echinocystis lobata T. & G. Gourd Family
[Plate XIV, right]

Growing along moors and in waste places over an area that reaches from New Brunswick to Manitoba and from Virginia to Texas, and flowering from July to September, the mock-cucumber is mainly an introduced plant in the eastern part of its range. Among its aliases are wild cucumber, wild balsamapple, mock apple, and creeping Jenny.

FLAME AZALEA

Azalea lutea L. Heath Family [Plate XV, left]

With a range that reaches from New York to Georgia and a flowering season that begins in May and ends in June, the flame azalea sometimes masquerades under the misnomer yellow honeysuckle. It is a beautiful and showy species and has been brought under cultivation with much success. So well does it respond to pampering that its finest, showiest flowers are produced by cultivation. It possesses little fragrance.

RED PINESAP

Hypopitys insignata Bicknell Indianpipe Family [Plate XV, right]

The red pinesap has a wide range in the eastern United States and Canada, and flourishes especially in or near mountains, where it can find shelter and humus under fir, beech, and oak trees. Its flowering season is from June to October. By refusing to go out and dig in the soil for its own living, and by insisting on preying upon dead vegetation to get its nourishment, the pinesap has received the brand of the Cain of the vegetable world. No plants that depend wholly on other plants, whether alive or dead, for their food can wear the green livery of the respectable flower world. Chlorophyll refuses to form in their tissues, and so they have to go up and down the earth wearing the badge of their depravity. The pinesap blossoms have a fringe of hairs radiating from their styles, and these form a stockade against insect pilferers.

HORSETAIL

Equisetum arvense L. Horsetail Family
[Plate XVI, left]

This representative species of the horsetail family flourishes in sandy soil, especially along roadsides and railways from Greenland to Alaska and southward to Virginia and California. It also is found in Europe. In Virginia it climbs the mountain sides to an elevation of 2,500 feet. Numerous aliases testify to its wide distribution. These include cornfield horsetail, bottlebrush, snake-pipes, and cats-tail. The flowering season of this best-known survivor of a great antediluvian race is May.

ROSEBAY RHODODENDRON

Rhododendron maximum L. Heath Family
[Plate XVI, middle]

The superb beauty of the rhododendron has won for it universal admiration and the dis-

tingtion of being the State flower of two commonwealths. The legislature of West Virginia and the State organization of women's clubs in Washington have elevated it above all other floral rivals in their communities. The chosen variety of West Virginia is *Rhododendron maximum*, while that of Washington is *Rhododendron californicum*, also called the coast rhododendron. The latter is the most splendid of western shrubs. Both of these species have delicate, waxen blossoms tinted like the "rosy-fingered dawn," with upper petals flecked with golden and greenish spots.

The rhododendron has no clever trick of showering its pollen upon insect visitors like the mountain-laurel, but it protects itself by exuding a sticky substance below the flower to shield the blossoms from ants and crawling insects that do not transfer pollen. The bee and other insect friends of the rhododendron find its nectar very appetizing, but the honey they make from it is said to be poisonous.

CAROLINA-JESSAMINE

Gelsemium sempervirens (L.) Ait. f. Logania Family [Plate XVI, right]

When South Carolina selected a flower for the national bouquet, she chose the Carolina-jessamine. As the sole American representative of the *Gelsemium* branch of the family, the Carolina-jessamine is admirably fitted for the rôle assigned, as to name, fragrance, and appearance. It flourishes in woods and thickets from eastern Virginia to Florida and west and southward to Texas, Mexico, and Guatemala. Its flowering season is from March to October, and among its incognitos are Carolina wild woodbine and evening trumpetflower. Its stem is slender, trailing or climbing, and sometimes reaches a length of 20 feet.

PURPLE TRILLIUM

Trillium erectum L. Lilly-of-the-valley Family [Plate XVII, left]

The purple trillium, inhabiting rich, moist woodlands, flourishes from Nova Scotia to North Carolina and westward to Manitoba and Missouri. Its flowering season is from April to June. Unfortunately its character does not measure up to its attractive name, for it has chosen to cater to the flesh flies rather than to the butterflies and bees. Its flowers have come to look something like raw meat and their odor to approximate that of decaying flesh. Hence its vernacular name—ill-scented wakerobin.

BLUETS

Houstonia caerulea L. Madder Family
[Plate XVII, middle]

The bluet lends its beauty to a geographical area including eastern Canada and southern Georgia and Alabama, reaching as far west as Michigan. Moist meadows and the banks of streams form its favorite environment. Its flowering season includes late April to late July, and a few come out even in the dogdays of August.

A long list of local pseudonyms proclaims how thoroughly this bluet has laid hold on the popular imagination. Some of these are quaker-ladies, Venuspride, innocence, angel-eyes, blue-eyed-babies, little washerwomen, and eyebrights.

The flowers appear in two varieties, some with a blue matching that of the cloudless sky and others with a white rivaling the snow. Indeed, a field decked with the latter looks as if it had received a tiny blanket of powdery snow.

This little bluet puts forth flowers of two structural forms. In the one the stamens remain in the lower part of the corolla tube and the pistils are extruded. In the other the stigmas remain below and the stamens are extruded.

But the two are not found mixed, for each produces after its own kind.

Many insects visit the bluets, but the small bees and the smaller butterflies are their most frequent guests. The common little meadow fritillary is always a busy little creature in its commerce with the bluets when they are in bloom.

COMMON MEADOWBEAUTY

Rhexia virginica L. Meadowbeauty Family
[Plate XVII, right]

A stout-stemmed perennial, which blossoms from July to September, over a range that reaches from Maine and Ontario to Florida and Louisiana, the common meadowbeauty is the best known member of its family in our latitude. It flourishes in sandy swamps, and its special insect customers seem to be the yellow butterfly and the honeybee. Possessed of the fine, fragile beauty that proclaims its tropical relationships, the meadowbeauty reminds one of the scarlet evening-primrose. A bright patch of these delicate, deep-hued flowers is always a delight to the eye, and even when the flowers are gone the scarlet leaves make a striking substitute for them. Thoreau, writing of the meadowbeauty, says: "The scarlet leaves and stems of the *rhexia*, some time out of flower, make almost as bright a patch in the meadows now as the flowers did. Its seed-vessels are perfect little cream-pitchers of graceful form."

TULIPTREE

Liriodendron tulipifera L. Magnolia Family
[Plate XVIII, upper]

Indiana's legislature years ago declared the pink carnation the Hoosier State flower. But as the years went by our Hoosier friends had a change of heart and deposed this fragrant blossom and enthroned the tuliptree—the only State in the Union that has ever deposed a legally acknowledged flower queen.

Variouly known as the lime-tree, blue-, white-, or yellow-poplar, lynntree, saddletree, basswood, hickory-poplar, tulip-poplar, saddle-leaf, and canoe-wood, the tuliptree has a range that reaches from Vermont to Florida and from Michigan to Arkansas and Mississippi, occurring mostly in woodlands and flowering in May and June. It is a magnificent tree, frequently attaining a height of 190 feet.

FRINGED POLYGALA

Polygala paucifolia Willd. Milkwort Family
[Plate XVIII, lower]

The fringed polygala dwells in moist, rich woods throughout a range whose northern limits include New Brunswick and Saskatchewan and whose southern boundary includes Georgia. It gets as far west as Minnesota. Flowering wintergreen, gay-wings, baby's-toes, little pol-lom, and bird-on-the-wing are some of its vernacular names. Its flowering season begins in May and usually ends in July.

When a bumblebee alights on the lower petal of the fringed polygala her weight so depresses the tubular petals that protect the stamens and pistil from rain, dew, and useless insects that the spoon-tipped pistil is forced out. It pushes the pollen deposited by the anthers outward and onto the breast of the bee. The stigmatic surface of the pistil is on the opposite side of the spoon from that which comes into contact with the pollen of the flower's own anthers. Then, as the bumblebee inserts her tongue into the nectar jar, some of the pollen from a previously visited flower adheres to the sticky surface of the pistil.

FOURLEAF MILKWEED

Asclepias quadrifolia Jacq. Milkweed Family
[Plate XIX, left]

This member of the milkweed family puts forth its blossoms in May, June, and July. Its range is from Maine and Ontario on the north to Alabama and Arkansas on the south. It occurs in woods and thickets usually. When one comes to examine the blossom with a magnifying glass he will perceive that the row of bodies which may casually be taken for stamens are in reality tubular bodies colored like petals, containing a curved, needlelike hook. The little tubes serve as hoods for the tiny hooks. Remove both the hoods and their hooks and the stamens will be revealed united into a tube standing around the pistil. The pollen in the anthers terminating the several stamens, instead of being in the form of grains, is in a long, flat, yellow mass.

COMMON LILAC

Syringa vulgaris L. Olive Family [Plate XIX, middle]

New Hampshire, by legislative act, recently selected a State flower, and everybody will applaud the choice of the common or purple lilac to represent it in the national family of official flowers. It is an escape from gardens to roadsides, and its range is from Maine to Virginia and westward. A native of eastern Europe, it was long ago brought to America by our flower-loving ancestors, and is supposed to have been taken to Vienna from Persia in the 16th century.

The several species of lilac cultivated in America usually have purplish or white flowers, and are valued for park and garden planting because of their hardiness and free-blooming

qualities. The wood of larger specimens is prized by cabinetmakers for turning and inlaying. The lilacs thrive best in deep, rich soil, but survive almost anywhere. They have a habit of growing suckers, of which advantage is taken in propagating. They may also be propagated by cuttings and by grafting on privet.

SENSITIVEPLANT

Mimosa pudica L. Mimosa Family [Plate XIX, right]

The sensitiveplant of our hothouses and Gulf States is a native of tropical America, but has been naturalized in corresponding latitudes in Asia and Africa. Shelley's famous poem "The Sensitive Plant" refers to this species of *Mimosa*. Its wide cultivation is due partly to the beauty of its bipennate foliage, but mainly to its sleepy movements and response to mechanical irritation. Light and darkness will cause it to wake or sleep; but even when touched the leaves will begin to assume an air of innocence and fold up. Shake the plant and not only do the leaves fold themselves but droop as well. But if the shaking be continued they seem to recover from the shock, open again and pay no further attention to the disturbance.

COMMON HOP

Humulus lupulus L. Nettle Family [Plate XX, left]

The common hop grows wild in thickets and on river banks from Nova Scotia and Manitoba to Georgia and New Mexico. It is an escape from cultivation. The flowering season is July and August and its seeds are ripe in September and October.

The hop, which is of great importance to the brewing industry, has been grown so long from cuttings that it has lost its ability to come true from seed, and such seeds as it does produce when male plants are grown are usually incapable of reproducing the plant. The cuttings are made from the underground stems. Varieties imported from Bohemia produce no male plants and it is said that they yield more hop meal than the varieties from which the male of the species have not been entirely eliminated.

The enactment of national prohibition has been a blow to hop culture in the United States. In 1913 this country produced 62,000,000 pounds of hops out of a total of 173,000,000 pounds for the whole world—or nearly 40 per cent of the total crop.

COMMON CARROT

Daucus carota L. Parsley Family [Plate XX, right]

Making itself a great nuisance to the farmer, and to the horses and cattle that eat the hay and grass into which it has intruded, the common carrot came from Europe. It has established itself throughout almost the entire United States. As the ancestor of the table carrot

much can be forgiven it. The wide distribution of this far-flung colonizer may be gathered by the number of aliases under which it passes in various parts of the country, such as bird's-nest, Queen Anne's-lace, laceflower, devil's-plague, and rantipole. Flowering from June to September, the blossoms of the carrot are lacy and attractive when in their prime, but as the frosts come they take on a careworn, disheveled appearance that makes them anything but beautiful.

The domestication of the carrot dates back to a period beyond historical times. Pliny reports that the finest specimens were brought to Rome from Candia. It is supposed to have been taken to England by the Dutch in the reign of Queen Elizabeth. In the writings of Parkinson it is related that the ladies wore carrot leaves instead of feathers in their hair at balls and banquets.

MAYPOP

Passiflora incarnata L. Passionflower Family [Plate XXI, left]

The State Horticultural Society has voted in favor of the maypop, or passionflower, as the State flower of Tennessee. The selection seems to be a popular one, and it has been given at least semiofficial recognition.

A climbing vine, sometimes attaining a height of 30 feet, the maypop flowers from May to July over a territory that reaches from Virginia and Missouri to Florida and Texas. The fruit, which is as large as a hen's egg, is a berry which becomes lemon-colored when ripe. The pulp is white and of a peculiar sweetish flavor that one either likes or dislikes very much.

HOARY TICKCLOVER

Desmodium canescens DC. Pea Family [Plate XXI, right]

The hoary tickclover, sometimes known as the hoary tick-trefoil, has a range that reaches from Ontario to Massachusetts and Florida, and westward to Minnesota and Texas. It prefers rich soils for its environment, and is in flower from July to September. In the tickclover we have another example of the way various families of plants undergo parallel evolution. The beggar-ticks and the Spanish needles succeed in sending their colonies abroad by attaching little hooks to their seeds. These fasten in the hair or wool of passing animals, or on the clothing of man, and thus employ animal transport in their colonization schemes. The tickclovers have developed the same method of sending their children away from the home roost, as it were, and with marked success.

RUGELS PLANTAIN

Plantago rugeli Decne. Plantain Family [Plate XXII, left]

This plantain resembles the common plantain, *Plantago major*, which is perhaps the best

known of the broad-leaved species. Its spikes are a little less dense, at least toward the base, and its leaves are a little thinner and of a brighter green. But otherwise the differences that make them two species instead of one would escape the eye of the layman.

Rugels plantain is found from New Brunswick and Ontario southward to Florida and Texas. Its flowering season is from June to September.

The common plantain flowers from May to September and has a range that includes nearly all North America and the West Indies. The Indians called the two species white-man's-foot.

NUTTALLS PONDWEED

Potamogeton epihydrus Raf. Pondweed
Family [Plate XXII, middle]

This species of pondweed is found in ponds and streams from Newfoundland to British Columbia and southward to North Carolina and Iowa. Its flowering season is from June to August.

GREAT RAGWEED

Ambrosia trifida L. Ragweed Family
[Plate XXII, right]

The great ragweed is sometimes known as horse-cane and bitterweed. It flourishes from Quebec and Manitoba to Florida and New Mexico. Since its pollen has an irritating effect on the mucous membranes of so many human noses, it has received the name hay-fever weed.

COMMON WOODRUSH

Juncoides campestre (L.) Ktze. Rush
Family [Plate XXIII, left]

This species of rush occurs in woodlands throughout the United States and Canada, and is also indigenous to Asia and Europe. It bears many common names, among them, sweeps, chimney-sweeps, black-caps, cuckoo-grass, and good-Friday. This species is fairly typical of the whole family, except that some of the others do not have tufted stalks.

VENUS FLYTRAP

Dionaea muscipula Ellis Sundew Family
[Plate XXIV, left]

Charles Darwin once wrote that he considered the Venus flytrap "the most wonderful plant in the world," and anyone who studies its behavior will doubtless agree with his verdict. It is found on the coast of the Carolinas in very limited areas. The edges of the leaves bear a series of little spikes and the slightly concave surface of each leaf half bears three or more fine, tapering bristles, hair triggers, as it were, to set off the trap. Touch one of these hair triggers twice or two of them once, and immediately the leaf closes, the spikes at the

two edges interlace, and you will see how the plant takes and retains its prisoners.

The trap is baited with sweets that are especially tempting to insects. When they spring it and are caught they are held lightly for the time being, as if the flytrap were debating the edibility of the catch. If the prisoner be too small for a good morsel, or a bit of nonnutritive matter, the trap will open and the prisoner be released. But if it be edible and nutritious, the trap closes down so rigidly that one can see the impression of the insect body through the leaf. Struggling to escape boots the prisoner nothing, for the harder the struggle the tighter the flytrap's hold.

The leaf secretes a digestive ferment, and with this it breaks up and absorbs the tissues of the erstwhile unwilling guest. When only the chitinous parts remain the leaf opens up again, casts out the "bones" of its feast, and sets its trap for the next victim.

CORALBELLS

Heuchera sanguinea Engelm. Saxifrage
Family [Plate XXIII, middle]

The coralbells belong to the genus *Heuchera*, of the saxifrage family. It very closely resembles its cousin *Heuchera americana*, the alum-root, which is the type species of the genus. Most of the species of *Heuchera* are essentially Mississippi Valley plants, although a few of them are found on the Atlantic seaboard. The flowering time of the coralbells and the other members of this genus is May and June.

PARTRIDGE PEA

Chamaecrista fasciculata (Michx.) Greene
Senna Family [Plate XXIII, right]

The partridge pea, locally known as the large-flowered sensitive pea, dwarf-cassia, and magoty-boy-bean, flourishes in dry soil from Massachusetts to Florida and westward to Minnesota and Mexico. It is an annual, sometimes spreading and sometimes erect, and flowers from July to September. Its behavior and appearance both remind one of the sensitiveplant of the mimosa family.

AMERICAN LOTUS

Nelumbo lutea (Willd.) Pers. Waterlily
Family [Plate XXIV, right]

This species, sometimes known as the water-chinkapin, sometimes as duck-acorn, and sometimes as the wankapin, lives in rivers and lakes from Massachusetts to Cuba and from Minnesota to Louisiana. The tubers and seeds are farinaceous and edible. It is a close relative of the Hindu lotus, which serves many useful purposes in the East. The filaments of the Hindu species are astringent and cooling, and are used in the treatment of burns; the leaves are used as bed sheets for fever patients; a sherbet made from it is given to smallpox patients as a refrigerant.



Photograph by Alexander Wetmore

THE LANDING ROCK ON NIHOA (SEE PAGE 77)

In modern times few persons have succeeded in getting safely ashore on this rugged island, 270 miles from Honolulu. The landing of men, food, and equipment for scientific work required judgment and skill on the part of the officers and men of the *Tanager*. It was safe to approach the landing rock only as the surf welled slowly in, when bundles were tossed to the man on the rock and passed up the waiting line behind, while the surfboat backed away to safety. At frequent intervals huge waves, threatening destruction, broke over the party, submerging the entire rock shelf. On this island the expedition found the saucy Nihoa Finch (not a true Finch, but a strong-billed member of the curious Hawaiian family *Drepanididae*) and a Millerbird, a form new to science, both species being restricted to this barren rock and found nowhere else in the world.

BIRD LIFE AMONG LAVA ROCK AND CORAL SAND

The Chronicle of a Scientific Expedition to Little-known Islands of Hawaii

BY ALEXANDER WETMORE

ASSISTANT SECRETARY, SMITHSONIAN INSTITUTION

With Illustrations from Photographs by Donald R. Dickey and the Author

WHEN the United States annexed Hawaii, in addition to the eight large, inhabited islands* that form the territory as the tourist sees it, a chain of islets that extend from the main group toward the northwest for more than 1,300 miles was also acquired (see map, page 79). Uninhabited by man, except for a cable station at Midway, these have been little known. In 1909, through the interest of former President Roosevelt, these Leeward Islands of the Hawaiian group were set aside as the Hawaiian Bird Reservation, and placed under control of the Biological Survey of the United States Department of Agriculture.

From time to time parties have visited Laysan, an important bird rookery, to study its wonderful bird life, and perhaps en route have landed for a few hours at one or two other points. On the whole, however, the group, from a scientific standpoint, has been unexplored.

Early in 1923 arrangement was made with the Navy Department for transportation and other assistance, and a co-operative expedition was organized by the Biological Survey and the Bishop Museum, of Honolulu, for a complete scientific exploration of these outlying islands. On April 4 a party of 12 left Honolulu on a thousand-ton Naval mine sweeper, the U. S. S. *Tanager*, for a four months' cruise.

Our party included a botanist, an entomologist, a geologist, a conchologist, an ornithologist, one or more collectors of fishes, miscellaneous marine animals, and plants, students of ruins left by man, a topographer, and one or two general assistants.

All had cameras, and, in addition, Mr.

* See "The Hawaiian Islands," by Gilbert Grosvenor, LL. D., in the NATIONAL GEOGRAPHIC MAGAZINE for February, 1924.

Donald R. Dickey, of Pasadena, Calif., an expert in motion and still photography of birds, accompanied the party to Laysan Island. As the representative of the Biological Survey, the direction of the work of the scientific party fell to me.

RELICS OF A VANISHED POLYNESIAN COLONY FOUND ON NIHOA

Though rough and inhospitable to the voyager (see page 76), the first island in the chain, Nihoa, proved of great interest.

Polynesians once had a colony of several hundred persons here. Level house platforms made of flattened stones rose one above the other in a little valley that, during rains, evidently contained water.

The steep slopes, now clothed with bushes, had been terraced with great labor to permit cultivation of the sweet potato and dry land taro, and a cave or two showed signs of ancient occupancy. In our excursions over the slopes we found a number of stone bowls fashioned from porous volcanic rock.

Legend runs that in early times a fisherman living on Nihoa had a beautiful daughter, desired by a prince of Kauai. When the latter came to claim her, the girl ran up the steep cliff paths, the prince in pursuit. At the ragged border of the *pali* (cliff) she stopped and cried: "If you touch me I shall jump." But the prince, unable to control his ardor, stretched out his hand to seize her.

Instantly the girl sprang to her destruction, while the prince was turned to a leaning stone, which still stands on the brink of the precipice, where it may be viewed in corroboration of the story!

Small groves of a slender palm grew in some of the gulches, while a scrubby, woody-stemmed plant allied to our common lamb's-quarters clothed the slopes.

In these were flocks of the saucy Nihoa



Photograph by Alexander Wetmore

THE U. S. S. "TANAGER" AT ANCHOR OFF NECKER ISLAND

This thousand-ton ship of the mine-sweeper class played an important part in laying the mine barrage in the North Sea. In 1923 the *Tanager* was assigned by the Navy Department to transport a party of scientists from the Biological Survey, United States Department of Agriculture, and the Bishop Museum of Honolulu during an extended exploration of islands in the Hawaiian Bird Reservation.

Finch (not a true Finch, but a strong-billed member of the curious Hawaiian family Drepanididae) and an occasional Millerbird (a form new to science), both species restricted in range to this barren rock, and found nowhere else in the world.

Hordes of Terns nested on the slopes, Boobies and Frigate Birds formed colonies in the bushes, and beautiful snow-white Love Birds nested in pairs on tiny ledges on the huge black cliffs. Albatrosses, found elsewhere near the sea, here nested on a flat 850 feet above the waves.

NECKER IS AN ISLAND OF MYSTERY

On November 4, 1786, the Frenchman La Pérouse sighted a rough, barren rock, west of the main Hawaiian group, which he named Necker Island in honor of the Swiss banker Jacques Necker, who at the time was busy in France with a futile attempt to stabilize the uncertain exchequer of an uneasy government. Though the

French exploring expedition remained in the vicinity of this rock for a brief time, no attempt was made to land, and the journal of La Pérouse comments mainly on the barrenness of the place.

From a distance Necker, where we had proceeded after completing work on Nihoa, appears as some misshapen, monstrous animal crouched amid the waves.

Though landing was simple, location of camp was difficult. We found a protected shelf 40 feet from the water, on which to tie the cook tent, while rough ledges above, partly protected by the overhanging cliff, furnished smaller platforms where the members of the shore party distributed their cots and scientific apparatus as best they might (see page 80). My own sleeping quarters were fully 70 feet above the water. We roosted at night like so many sparrows. Never have I occupied a rougher spot for a camp.

Nihoa was well known to the ancient Hawaiians, but Necker had no known native name, nor does it figure in the



Drawn by A. H. Bumstead

A MAP OF THE HAWAIIAN ISLANDS

In addition to the eight principal islands of the Hawaiian group (Hawaii, Maui, Kahoolawe, Lanai, Molokai, Oahu, Kauai, and Niihau), a chain of islets extends to the northwest for more than 1,300 miles. Of the latter, Nihoa, Necker, French Frigate Shoal, Gardner, Dowsett and Maro Reefs, Laysan, Lisiansky, Pearl and Hermes Reef, Midway and Ocean Islands were studied by the *Tanager* Expedition, led by Dr. Alexander Wetmore.

many legends of that people. There are found, however, on this isolated bit of rock, far below the horizon from distant Nihoa, many signs of occupancy by ancient, more or less primitive man.

A wonderful series of more than 40 *heiaus*, or stone temple platforms, rectangular in form, ranging from a few feet to 60 feet in length by half as wide, were found on the higher points of the island.

The floors of these ancient temples were smooth, except where a raised platform two or three feet wide had been constructed to a height of 12 or 15 inches across one of the long sides. At regular intervals along its back were blocks of stone a foot or more wide by three or four feet high.

That the platforms were ancient temples is shown by the discovery 30 years ago of crude stone idols, that lay prostrate where they had fallen from the erect border stones. Many of these were destroyed through the mistaken Christian

zeal of a royal edict, but fortunately a few have been preserved in museums.

In addition to the temple ruins, small shelter caves scattered over the sloping cliffs were found to contain occasional bits of stone bowls, a low retaining wall to level the floor, or the remains of a primitive fireplace.

NECKER MAY HAVE BEEN A POLYNESIAN PLACE OF PILGRIMAGE

There is on Necker no dependable water supply, nor are there food resources or sufficient space for the support of a permanent population. Obviously, then, worshipers came from a distance, possibly from Nihoa, perhaps from the formerly populous Napali cliffs of the island of Kauai.

May we not suppose that here flourished an ancient religion, followed in later years by a few initiates who kept alive on this remote rock altar fires of a cult whose sacred name was unknown to the general populace—a religion whose rites were so fearsome or so holy to the devo-



THE HEIAUS OR TEMPLES ON NECKER, NOW FREQUENTED ONLY BY BIRDS

Large upright stones stand on a raised shelf built at the back of each level platform. The birds in the photograph are young Laysan and Black-footed Albatrosses, with a young Blue-faced Booby in the center.



Photographs by Alexander Wetmore

THE WESTERN END OF NECKER ISLAND

Camp for the author's shore party was established on the cliff at the left, above the landing ledge. The two tents were used for cooking and storage. The men worked and slept on the small ledges above, wherever there was room for a cot or collecting equipment (see page 78).



Photograph by Alexander Wetmore

A LANDING ON THE ROUGH SHORE LINE OF GARDNER ISLAND

The amount of rise and fall of the waves may be judged from the surf on the rock in the background. To negotiate these landings successfully requires skill and experience on the part of steersman and boat's crew.

tees as to preclude their celebration in public, or their mention in story, so that with the decadence of the older people all knowledge of their form has disappeared?

Such ponderings are appropriate as one reclines at dusk on a rocky ledge high above the sea, with the wash and crash of waves as a background for the mosaic of sounds formed by the yelping of Terns, the croaking of circling Boobies, and the soft barking notes of gentle Pet-

rels among the rock crevices; or when one awakens as the first rays of dawn touch the clouds at the horizon, and untold thousands of Terns, as if at a pre-concerted signal, rush out from the rocks in a vast cloud to greet approaching day.

Neither here nor on Nihoa did the *Tanager* party discover ancient human burials whose bones might aid in revealing who the early visitors to the islands were.

From Necker we continued west for a



Photograph by Alexander Wetmore

THE BLACK-FOOTED ALBATROSS FEEDS HER YOUNG BY REGURGITATION

This bird is the dark-colored "Gooney" that follows in the wake of trans-Pacific steamers. On their breeding grounds they live almost entirely upon small squid taken at sea.

brief stay among the 13 sand islands and the pinnacle rock that mark French Frigate Shoal. Beyond lies Gardner Island, an inaccessible rock, according to the United States Coast Pilot. If others had effected a landing here before our visit, there is apparently no record of the fact. The main rock, only 200 yards long, is composed of two peaks, the highest rising 170 feet, with a deep cleft between. A smaller rock is separated from the first by a narrow strip of water.

BIRDS WITH SAW-EDGED BILLS BITE EXPLORERS

We found only a single species of plant on this island, a fleshy-leaved form restricted to a handful of individuals, though I saw a good many heavy-spined seeds of a creeper (*Tribulus cistoides*) that grows commonly on low sand islands. These probably were brought here in the feet or plumage of sea birds that had come from Laysan or French Frigate Shoal. Though dropped on a barren rock without sufficient soil for

their growth, they served to illustrate how such spiny plants are transported to lonely islands.

Terns of five species rested both on the gentler slopes and on the steep ledges. Tropic Birds nested in holes below the summit, and the whole upper third of the island was given over to the Blue-faced Boobies, now on guard over their well-grown young.

These snow-white Boobies were as large as geese, and it was necessary to drive the squalling adults ahead of us, for when we passed them quietly they had a way of waddling up behind us and biting savagely with their heavy saw-edged bills. Their attack was often disturbing when one was picking a precarious path along some narrow ledge.

LAYSAN, THE ALBATROSS METROPOLIS

Traveling west from Gardner Island, one soon comes to Dowsett and Maro Reefs, named from ancient shipwrecks. These are mere coral rings marked by breakers and without visible land. Then,



Photograph by Alexander Wetmore

FRIGATE BIRDS, KNOWN ALSO AS MAN-OF-WAR BIRDS, SWOOPING DOWN TO SEIZE
FISH CAST IN THE AIR

These great birds are piratical in habit; they feed largely on squid or fish taken forcibly from Boobies, Terns, or Shearwaters.



Photograph by Donald R. Dickey

A BIRD IN THE HAND

Steward George, of the *Tanager*, remonstrated daily with a certain Red-tailed Tropic Bird against its determination to make a nest in the cook shack, back of a case of Navy rations. To the end of a three weeks' stay on Laysan Island, George remained gentle; the Tropic Bird adamant, tame and broody! So, it is hoped that this bird forgave the party the bustle and clatter incident to the preparation and dispatch of sundry turtle stews, and that subsequently it raised its single youngster in the shade it sought.

over the horizon, beyond the dangerous jaws of these hidden traps, comes Laysan Island, 855 nautical miles from Honolulu.

Ever since its discovery, Laysan has been famed for its sea birds. Pilot books and the logs of navigators through these waters describe their hordes, and even the Hydrographic Office charts depict the low elevation of Laysan, with the air above filled with birds. Though only a mile and three-quarters long and a mile wide, it is the most pretentious of the islets in the Leeward chain.

An elevated rim, rising somewhat abruptly from the beach line to a height of 20 to 40 feet, incloses a shallow, oblong basin, in whose center is a saline lagoon with waters concentrated by evaporation under a blazing sun, until they are far more heavily charged with salt than the sea itself.

At an early date it was discovered that there were valuable deposits of guano on Laysan, or Moller, as it was then known, and for some years the island was of considerable commercial importance.

The nineties of the last century marked the height of the guano industry. A gradual decline began in 1900, and by 1908 shipments had ceased and the island was practically deserted, leaving a number of frame buildings clustered about the landing, a few hundred yards of rails laid across the sand, and three or four scattered piles of phosphatic rock dug out for shipment and then abandoned.

Through all these years Laysan had



Photograph by Alexander Wetmore

A CAST OF THE NET

A sheath knife is usually worn by swimmers in the waters adjacent to Laysan Island as a protection against sharks.

been literally covered by myriad sea birds, while the grass and shrubbery that clothed the island harbored five species of land birds restricted to its less than two square miles and known nowhere else in the world in a native state. These included a tiny flightless rail, a species of duck, a warbler, known as the Miller-bird, and two species of Drepanididæ (see also text, page 78), one as large as a sparrow, with strong robust bill, known as the Laysan Finch, or "Canary," and the other smaller, with slender beak, the Laysan Honey Eater, called from its coloration the "Redbird."

Laysan is the metropolis of the Laysan

Albatross, a beautiful bird as large as a goose, with snowy breast, black wings, and delicately tinted bill. With it is found the Sooty Albatross, the "Gooney," familiar to tourists on trans-Pacific steamers, of equal size, but with sober sooty-gray plumage.

MARAUDERS DECIMATE LAYSAN

For a part of each year these Albatrosses frequent the high seas, true seafarers, who see no land even during periods of storm. About the first of November they resort to remote, uninhabited islands where they gather in colonies, as have their ancestors for thousands of generations, for the purpose of rearing young.

On Laysan their return each year was an event in the life of the guano workers, heralded with as much excitement as the arrival of some famous traveler in settled communities.

Early visitors who came to Laysan, with considerable exaggeration, placed the numbers of Albatross in the millions; actually they ran to many thousands. Mated pairs of the Laysan species dotted the whole inner basin except where bushes prevented their nesting, while the Sooty Albatross colonized the barren sand beaches.

Unmolested for centuries on land, the birds of Laysan knew their only enemies in the sea, so that man on his arrival was accepted as a phenomenon of interest, to be treated without fear. Aside from a certain amount of eggging, and the pulling of the long, ornamental, central tail spikes of the Red-tailed Tropic Birds, the guano workers troubled the birds little except for the necessary infringement on their breeding areas.

When, in 1909, the entire Leeward chain, with the exception of Midway (which is under the jurisdiction of the Navy Department), was set aside as the Hawaiian Bird Reservation, it seemed that this action would provide final protection for the harmless, friendly hordes of sea birds that nested there. But other forces were at work. Fashion still demanded feathers for feminine adornment, and this trade, blocked for the time within the limits of the United States, turned to more distant fields.

Word came somehow to Honolulu that

poachers were at work to the westward, and in January, 1910, the revenue cutter *Thetis*, under Captain W. V. E. Jacobs, surprised and apprehended 23 Japanese on Laysan and near-by Lisiansky, engaged in killing the birds. One lot of plumes is supposed to have been shipped before the arrival of the *Thetis*, yet the wings and other feathers of more than a quarter of a million birds were still stored in the old buildings on Laysan.

The vast rookeries had been systematically decimated by men armed with clubs. Hand cars and the old rail line left by the guano workers had been utilized to bring the spoils to camp for preparation and treatment, and, as usual in plume-hunting operations, the ground round about displayed the sad accompaniments of decaying carcasses and dead or starving young, among which wandered a few bewildered or crippled birds.

Prompt action had, however, saved part of the bird colonies, and, free from further attack, the Albatross and Tern were left to regain something of their former numbers.

THE RABBIT MADE LAYSAN A DESERT ISLE

With danger from plume hunters eliminated, one might suppose that the bird colonies on this distant bit of American soil would flourish as in ages past, but further tribulation was in store. Disturbances to the supersensitive adjustment of Nature's forces through the coming or the temporary presence of civilized man are often strange and unexpected in their appearance and cumulative effects. As an instance, on Laysan tremendous damage has been wrought through the agency of the domestic rabbit, an animal that we might consider one of the most inoffensive of man's friends.

Some time in 1902 the foreman of the guano works brought to Laysan three or four pairs of rabbits, partly to amuse his children, and partly for the fresh meat that they would furnish. For a time the animals were kept about the houses, but gradually a pair or two wandered away, attracted by broad tracts of grass, succulent herbage, and protecting shrubs. Rabbit enemies there were none, as cats and dogs were forbidden because of their damage to birds.



© Donald R. Dickey

THE SPIRIT OF LIGHT

The quiet curiosity of the Love Tern is in striking contrast to the screaming threat of other Terns. One of the sailors of the *Tanager* actually had one of these gentle birds alight on his outstretched, motionless hand. This incident is evidence of that rare bird comradeship which remains to the author as his most intimate memory of Laysan Island.



© Donald R. Dickey

POISED FOR THEFT

This air pirate (see, also, page 89) hovers on incomparable wings before swooping down to snatch a nest stick from neighbors of its clan, even as it snatches daily food, by threat or violence, from the unwilling Booby and Shearwater. In recent years the destructive rabbit has made nesting material a supreme desideratum of the Frigate Birds of Laysan Island.



© Donald R. Dickey

THE FRIGATE BIRD OF THE SAILOR

The female of *Fregata* retains a proper white and feathered throat throughout the year, but during the mating season the male develops a highly inflatable gular sack of flame-red, naked skin. With this weird and colorful throat pouch he wiggles his comic invitation from a chosen nesting site to the females soaring overhead. Then, as a lady yields and builds the nest he has visioned on the chosen site, this strangely decorative and otherwise useless toy balloon shrinks quickly to the texture and insignificance of a turkey's wattle, and the male Frigate Bird loses, for the season, one of the strangest of secondary sex adornments.



© Donald R. Dickey

GETTING UP SPEED

The Laysan Albatross gets under way with effort—with strenuous taxiing, with kicking legs, and scattered sands (see, also, page 91).



© Donald R. Dickey

READY TO "TAKE OFF"

If any bird has an important aviation lesson to teach us, it is the Albatross, for its soaring grace intrigued the thoughts of man long before he dreamed of human flight. After centuries, it remains, perhaps, the best example of specialized adjustment to the complex of air current, mass, and gravity (see, also, pages 90, 96, and 102).



© Donald R. Dickey

THE RED-FOOTED BOOBY LOOKS OUT UPON THE WORLD FROM A SHOE-BUTTON EYE
This is one of the three species of Booby found by the *Tanager* Expedition on Laysan Island
(see, also, illustration, page 100, and text, page 103).



Photograph by Donald R. Dickey

A YOUNG LOVE TERN SITS IN MEDITATION: LAYSAN ISLAND

This species clings as tenaciously to precipitous limestone walls as did its ancestors to nestless, horizontal limbs (see, also, illustrations on pages 87 and 94).



Photograph by Donald R. Dickey

THE LOVE TERN'S NEST

This gentle sea bird was wont, in the good old days of sturdy vegetation on Laysan Island, to balance its annual egg, nestless, upon a precarious horizontal limb—a strange arboreal habit for a Tern, doubtless originated by the species out of bitter experience with land crabs or some other enemy in its more southern metropolis. When the man-curse of the rabbits eradicated the bushes from Laysan, the Love Tern quickly adapted itself to the sudden ecologic change, and now lays its egg on the precipitous pinnacles and shelves of a rock ledge at the southern end of the island.



© Donald R. Dickey

A COLONY OF WEDGE-TAILED SHEARWATERS ON THE SANDS OF A SHELTERED COVE OF LAYSAN ISLAND

The scene typifies the calm spirit of an atoll in the Pacific. Despite the man-wrought change caused by the introduction of rabbits, in the spring sea birds still come to Laysan in countless thousands to nest (see text, page 86).



© Donald R. Dickey

A BIRD'S-EYE VIEW

Unlike the bird of Coleridge's lay, which "came to the mariner's hollo," the *Tanager* Expedition found the Laysan Albatross strangely shy of ships at sea. Once on land, however, these same birds accepted members of the party as peers, eyed them merely in curiosity, pried at the shiny tripod screws, investigated sleeve buttons, and actually cakewalked up to nibble gently at the author's fingers with bills that could easily have ripped an artery! Is not this familiarity on land but simple proof that these sea birds have never had a land enemy? At sea, sharks and other foes have doubtless harried them, but on land, on their nesting grounds, no single enemy has arisen to teach them sophistication. The tribal history of the Hawaiians bears out this obvious theory, for no record of these farther outlying islands antedates their discovery by historic navigators. No other potential bird enemies exist on these islands, where sea birds have doubtless nested for thousands of generations. What more natural than that they should to-day greet an itinerant naturalist merely as a curious, overgrown peer?



Photograph by Alexander Wetmore

A GREEN TURTLE ASLEEP ON A SANDY BEACH: LISIANSKY ISLAND

These grotesque creatures browse in submarine fields of algae until hunger is satisfied, and then crawl heavily out to sprawl in the sand, safe from enemies in the sea. On one occasion, the author, while walking 300 yards along the beach on Lisiansky Island, counted 80 of these creatures from fifteen inches to four feet in length. Others, feeding a few yards offshore, were hidden by ripples on the water and so escaped this casual census. Their only enemies seem to be sharks.



THE RED-TAILED TROPIC BIRD

Seen against a Laysan sky, with plumage of snowy white, and bill and strangely specialized median tail quills of flaming red, this bird is a never-to-be forgotten picture of color and of life on Laysan Island.

© Donald R. Dickey



THE BLUE-FACED BOOBY OF LAYSAN CONTENTS ITSELF WITH A GUARDED HOLLOW IN THE SAND, IN WHICH TO INCUBATE TWO CHALKY EGGS

© Donald R. Dickey

According to Dr. Loye Miller, one of our few authorities on avian paleontology, the strange factor of evolution which sealed up the nostrils of the Booby was operative at least as early as the Miocene Period. This trick of Nature saddled these birds with a bill expression which remains comic to this day.



Photograph by Donald R. Dickey

THE ONE REMAINING TENEMENT OF LAYSAN ISLAND

This ironwood has resisted the tooth of the devastating rabbit (see page 103) and the blast of consequent sand storms, until to-day Red-footed Boobies and Hawaiian Terns crowd in upon it as the only nesting site on the island reminiscent of their ancestral home.



Photograph by Donald R. Dickey

SOOTY-BACKED TERNS FACING THE NORTHEAST TRADES

About the central lagoon of Laysan Island a growth of fleshy *Sesuvium* still persists, despite the rabbits. On this cool carpet colonies of the Laysan Albatross (see pages 90, 91, and 96) and of this Tern congregate to nest.



ALOFT IN A STIFF TRADE BREEZE

© Donald R. Dickey

Once a-wing, the Albatross attains the ideal of banking and of soaring flight (see, also, pages 90, 91, and 96).

Albatross must have gazed with tolerant curiosity at these lop-eared invaders, with their curious hobbling gait, while no doubt many an irate Shearwater hustled them with much strong language (if tone of voice is any criterion the Wedge-tailed Shearwater is a master of profanity!) from the shelter of his nesting burrow.

With abundant food and a genial climate, bunny's increase was incredibly rapid.

NATURE'S BALANCE UPSET, DISASTER FOLLOWS

Early accounts of Laysan Island and photographs taken 20 years ago depicted it as a pleasant spot covered with green vegetation. Reports of damage to shrubbery had led us to expect some changes, but had not prepared us for the utter desolation that greeted Commander King and me when we landed in the little harbor and walked slowly up the sandy slopes to a point near the tumbledown buildings remaining from the guano workings.

On every hand extended a barren waste of sand. Two coconut palms, a stunted hau tree and an ironwood or two, planted by former inhabitants, were the only bits of green that greeted the eye. Other vegetation had vanished. The desolateness of the scene was so depressing that unconsciously we talked in undertones. From all appearances, Laysan might have been some desert, with the gleaming lake below merely a mirage.

Without the restraining influence of active enemies, rabbits had multiplied until they had absolutely stripped the island and then had slowly starved. Of the vast army of destroyers only a few hundred remained.

We had come prepared to eliminate the rabbits, so, with camp established, the work began at once. The destruction of the majority was simple, but the survivors became wary and it was necessary to hunt them out one at a time.

Perhaps the procedure appears heartless, but it was one of necessity. Left unchecked, the creatures might have eked out a precarious existence for a few years longer, but starvation was the inevitable fate in store for them, coupled with unending hardship for the multitude of other creatures associated with them. Further-

more, so long as rabbits remained on Laysan there was danger of their transportation elsewhere, with resultant injury to other pleasant spots.

Pursuit, therefore, was relentless and effective. A party sent to Laysan a year after our visit reported no sign of a single survivor.

In spite of the rabbits, a few dozen Laysan Finches still sang their sprightly songs about the buildings or hopped among the rocks near the lagoon. Three individuals alone of the little Honey Eater remained on our arrival; these perished during a three-day gale that enveloped everything in a cloud of swirling sand. The Millerbird had disappeared entirely, and of the Laysan Rail but two remained. The duck (properly called the Laysan Teal), never numerous in recent years, as it was killed for food, had about held its own, 20 individuals being present—a scant foothold on existence for its species.

The Albatross, though reduced in numbers, were still present by thousands, and with them were many Boobies, Frigate Birds, and hosts of Shearwaters and Terns. The White-breasted and Tristram's Petrels, small species that appear mainly at night, were the only sea birds that seem to have suffered. They had almost disappeared; drifting sand, no longer restrained by vegetation, had buried them alive in their earthen burrows dug for hiding places against the light of day, or to conceal their nests.

Let us hope for happier days when, with vegetation renewed, these birds may repopulate their former territory from colonies on near-by islands.

LAYSAN RABBITS DEVASTATE LISIANSKY

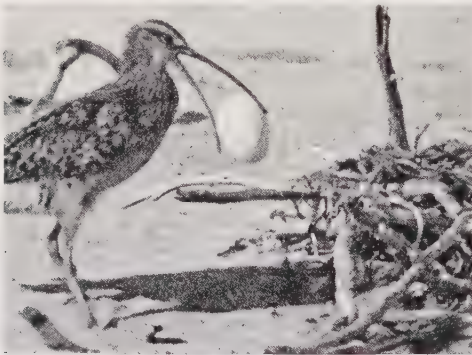
The island of Lisiansky, 120 miles west of Laysan, was named in 1806 by the Russian explorer, Urey Lisiansky, while en route from Sitka to Canton. For two or three days his seamen had noted flying birds and other signs of land and one evening, without warning, his ship grounded on a coral reef.

After two days' severe labor it was salvaged and Lisiansky went ashore on the island within the reef. He described it as covered with creepers and other vegetation, but a desolate place, whose soil was undermined by the burrows of



A BRISTLE-THIGHED CURLEW

This bird navigates nearly 3,000 miles of open sea from its Arctic nesting grounds to its winter resort in Polynesia.



Photographs by Donald R. Dickey

A BEAKFUL

The author found these Curlews consistently robbing the birds which nest on Laysan Island. No shore birds save those which visit Polynesia have ever been convicted of cannibalism.

a dovelike bird, with a mournful, moaning note (the Wedge-tailed Shearwater).

We sighted Lisiansky through an early morning haze, but came in slowly over uncertain shoals to an anchorage, so that it was afternoon before we landed.

The island is a parallelogram a nautical mile long by slightly less than a mile wide. A low ridge 40 feet high on the northeast marks the highest point, while the central portion forms a low basin bounded by a rim that protects it from the ocean. In an early stage this basin was in all probability a lagoon like that at Laysan.

Never have I seen a more desolate spot. Rabbits, brought from Laysan by misguided persons who thought to leave a food supply for possible castaways from shipwreck, had completely stripped the

island of its vegetation and then had died of starvation. Their bleached and weathered bones strewed the sands.

A few roots of grass and of pigweed had grown sufficiently deep to escape the incessant search of the starving four-legged pests and, with the final disappearance of the mammals, had begun a battle against the forces of wind and sand to recover the island.

Insect life had also practically disappeared, and land shells, abundant on most of these islands, were extinct. A species of rat had been reported as plentiful here, but it had also vanished and no specimens of it have been preserved for science.

A view of the life of the surrounding sea offered a welcome contrast to the dismal aspect of the land. We were struck in particular by the large number of sea turtles. Shallow coves along the beaches were filled with luxuriant growths of algæ, submerged fields of green kept in constant motion by passing waves. Amid these plants browsed dozens of turtles, at intervals thrusting their heads up for air, and then submerging to continue their feeding. When satisfied they crawled clumsily out on the sloping sands to lie in peaceful sleep (see page 97).

CABLE COMPANY TRIES TO BEAUTIFY LONELY ISLAND ROCK

Rough and stormy weather marked our stop at Pearl and Hermes Reef, where we found several low sand islands scattered over a broad lagoon. Colonies of the rare Hawaiian monk seal and many other creatures of interest were found here, and it was with regret that we terminated our brief stay and continued our journey.

The atoll known as the Midway Islands, usually abbreviated to "Midway" (see page 86), is now under lease to a cable company which here operates a relay station on the line between Guam and Honolulu.

Here reside 12 to 15 whites and an equal number of Orientals, who act as servants, in touch with the world only through the long undersea line that reaches both east and west. At intervals of three months a supply boat brings mail and stores from Honolulu.

At the time of our first visit we were received with delight, as the cable boat



"MAY I HAVE THIS DANCE?"



"DELIGHTED, I'M SURE!"



AFFECTIONATE RUBBING OF NOSES IN TRUE POLY-
NESIAN FASHION



"EXCUSE ME, PLEASE, WHILE I FIX MY
SHOULDER STRAP"



THE DANCE HAS INFINITE VARIETY, BUT



IT INVARIABLY ENDS IN GROANING EXALTATION

Photographs by Donald R. Dickey

PORTIONS OF THE FIRST MOTION PICTURE EVER MADE OF THE WEIRD DANCE OF THE
LAYSAN ALBATROSS

This dance doubtless originated as a corollary of courtship, but to-day it seems to have lost practically all sex significance. All through their stay on the island the birds dance, apparently for exercise or for the sheer joy of the fantastic measures. Throughout the colony, bird after bird seeks out a willing partner and takes up the dance in screaming exuberance.



Photograph by Alexander Wetmore

A YOUNG FRIGATE BIRD (SEE, ALSO, PAGES 88 AND 89): LAYSAN ISLAND

The great wings, that in a few weeks will bear it gracefully in the air, now hang below the breast.

had been out of commission and we brought the first mail that had been received in four and a half months.

The lagoon at this atoll contains two main islands, Sand, on which is located the cable station, and Eastern, a mile or more distant. Each is perhaps a mile long and rises well above the reach of the highest seas.

The cable company has worked steadily to improve conditions on what originally was a desolate spot of glaring sand and scattered bushes. The main buildings, four in number, are of steel and concrete, arranged at the corners of a little plaza. Earth, brought in sacks from Honolulu, covers the barren sand near the buildings and nourishes pleasant lawns, clumps of ornamental shrubs and flowers.

The whole is surrounded by a heavy protective windbreak of ironwood, or casuarina, trees between whose trunks one may catch glimpses of the clear green

waters of the lagoon. Tree-lined walks lead to the wharf and to a garden, where vegetables thrive, with abundant weeds imported with the garden earth.

A few sheep and a cow or two, high windmills in the background, and the introduced vegetation give a suggestion of some Argentine *estancia*, an illusion that is dispelled by a few minutes' walk that takes one to the bleak, wind-swept sands outside this artificial paradise.

As a unique feature of its bird life, Sand Island has a thriving colony of domestic Canaries which live at freedom in the shrubbery. In the mild and pleasant climate they have increased from a few pairs to several hundred individuals.

The Laysan Finch and the little Flightless Rail have also been naturalized here and on Eastern Island. A morning awakening in a comfortable room at the cable station, with a cheerful chorus of song from Canaries and Finches, offered a



Photograph by Alexander Wetmore

PROUD BOOBY AND CHICK

pleasant contrast to the matutinal salutation of a multitude of Shearwaters, heard through the canvas walls of a tent whipping in the steady trade winds, that was our portion elsewhere.

SHIP'S GIG TRAVELS 1,300 MILES FOR
HELP

Though barely over the horizon from Midway, Ocean Island, the most north-western point in the Leeward chain, is seen more seldom than any of the other atolls or islands in the entire Hawaiian group. On older maps other islands, marked as Patrocinio, Morrell, or Byer, are shown farther to the west, but modern surveys have failed to establish their existence.

Ocean Island consists of an irregular circle of coral four miles or so in diameter, with a semicircular fragment, known as Green Island, 1,800 yards long by 300 yards wide, at its eastern side.

Green Island, only 25 feet above the sea at its highest point, is so low that the atoll is a considerable menace to naviga-

tion in these waters. The surrounding reef has brought destruction to a number of ships.

Perhaps the most celebrated shipwreck at Ocean was that of the U. S. S. *Saginaw*, under Lieut.-Commander Montgomery Sicard, engaged in 1870 in deepening the channel into the lagoon at Midway. On completion of this work the *Saginaw* proceeded to Ocean Island, to verify its position, and to examine it for possible shipwrecked sailors.

A course was laid to bring them to this island at daybreak, but at three in the morning, with only brief warning, the *Saginaw* ran on the reef, and by dawn had been pounded in two by the surf.

The ship had struck near Green Island, the crew remained from the end of October, 1870, until January, 1871, living in part on the scanty stores saved from the ship, but mainly dependent on seals and sea birds.

Five men in the ship's gig made the perilous journey to Hanalei, Kauai, where they were wrecked in the surf as they at-



Photograph by Alexander Wetmore

THE CAMP OF THE AUTHOR'S SCIENTIFIC PARTY ON JOHNSTON ISLAND

tempted to land, and four of their number drowned; the survivor, William Halford, brought news of the plight of the *Saginaw* and a ship was dispatched from Honolulu to rescue her crew. The ship's gig, which made the perilous journey of more than 1,300 miles for aid, may be seen in the Naval Museum at Annapolis.

THE FIRST NATURALISTS TO VISIT OCEAN ISLAND

So far as I know, Green Island had not been visited previously by naturalists, so that our explorations were made with keen anticipation.

A shelving beach of coral and shell sand, 50 to 80 feet wide, extends entirely around the island. Inland we found series of low sand dunes grown with a peculiar shrub, sometimes known as beach magnolia (*Scævola lobelia*). In the center of the island, sheltered by the dunes, were irregular openings grown with grass and creepers.

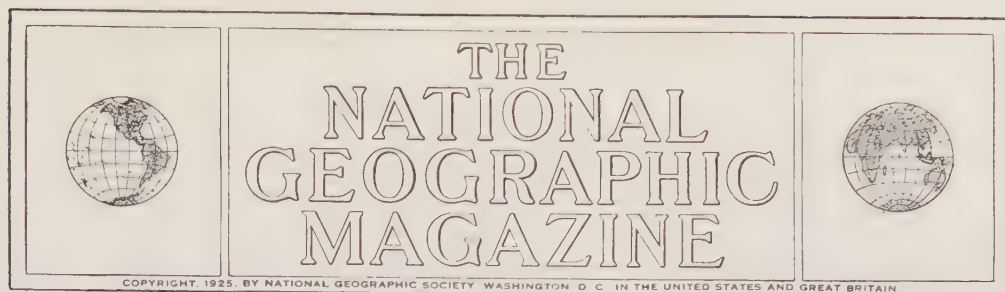
Ocean Island, like Pearl and Hermes Reef, is a stronghold of the Hawaiian monk seal that hauls and breeds unmolested on the beaches. Albatross are common, and we found the open inland meadows honeycombed with myriad Petrel and Shearwater burrows, so that every few steps we fell in to our knees

through the roofs of these hidden pitfalls.

The inner meadows are death traps for many Laysan Albatross that drop in here casually, deceived by the apparent security and protection from wind. A few seem able to rise on the wing without difficulty; others in running to gain the momentum necessary for flight (see pages 90 and 91) trip on long vines and creepers and fall headlong. Discouraged by successive occurrences of this sort, they walk about until weakened and finally die of starvation.

Among other creatures, we found here multitudes of rats, about one-fourth the size of our gray rat and related to the native Hawaiian rat, now extinct except for a little colony on Popoia Island, off the north shore of Oahu.

These rats on Ocean Island, long-tailed, brown-haired, heedless creatures, appeared at dusk in swarms, so that by morning the sand was laced with their tracks. They belong to a group whose forms are widely scattered in the Pacific, and may have been distributed from island to island as stowaways in the great sailing canoes of the Polynesians. Their spread by this means is as logical as the known spread of the gray rat by means of the sailing ships of the Caucasians.



WAIMANGU AND THE HOT-SPRING COUNTRY OF NEW ZEALAND

The World's Greatest Geyser Is One of Many Natural
Wonders in a Land of Inferno and
Vernal Paradise

BY JOSEPH C. GREW

UNDERSECRETARY OF STATE, U. S. STATE DEPARTMENT, AUTHOR OF "SPORT AND TRAVEL IN THE FAR EAST"

Members of the American Fleet, now enjoying the sights of Australia and New Zealand, will upon their return to the United States in September have wonderful stories to tell of the antipodes. They are especially fortunate in that Waimangu (Black Water), the world's greatest geyser, for many years quiescent, has resumed activity, but not on the magnificent scale observed by the author.—THE EDITOR.

IN THE North Island of New Zealand, if you drive from Rotorua straight back through the scarred and roughened lava-strewn hills toward Mount Tarawera, that old volcano of such grim associations, you will come upon what appears to be a peaceful pond lying motionless in a depression among the hills.

Among its dreary and barren surroundings not a living thing is to be seen; the thin steam that rises gently from its surface and from the other pools near by is the only sign of movement that breaks its stillness.

From the plateau in which it is sunk rise, in two directions, great rugged cliffs; and these form, as it were, a natural stadium in whose arena below is enacted at intervals one of the most marvelous and sensational spectacles which the natural phenomena of the world produce. For this is Waimangu, the largest geyser in the world, but a geyser whose action re-

sembles far more the eruption of a great volcano than it does that of the slender jets of steam and water with which one usually associates the name.

When, in 1886, the appalling eruption of Mount Tarawera altered the face of the whole country, leaving in its path widespread loss of human life, destruction of villages and of millions of acres of cultivated fields, New Zealanders did not realize what a mighty landmark had been given them as compensation. They could only bemoan the loss of their famous Pink Terraces, which Tarawera had so ruthlessly torn from them, and they could not foresee the monument which was then set in course of construction to commemorate that terrible June night.

For Waimangu, though it was undoubtedly formed by that great upheaval, did not at once make known its birth. For 14 years it lay quiescent, slowly gathering power for the day on which it



Courtesy New Zealand Government

THE LOST WHITE TERRACES OF LAKE ROTOMAHANA

Under the 5,600 acres of this lake's waters lie the famous Pink and White Terraces, the most beautiful objects in the thermal regions before the destructive eruption of Mount Tarawera (see text, page 109). They were formed as basins by the sediment of the mineral waters from a geyser above the lake, and the floors were filled with clear, blue, boiling water. The tiny cascades playing over the terrace walls were transmuted by the sun's rays into sparkling, colorful showers of jewels. No similar terraces have formed since the eruption.



Photograph from Joseph C. Grew

THE BASIN OF WAIMANGU AND MOUNT TARAWERA

The basin is a two-and-a-half acre hollow covered with black, steaming water. Tarawera is a three-peaked ridge, visible for miles in every direction, with its gaping summit and fissured slopes bearing witness to its prodigious eruption of 1886 (see text, page 109). It is estimated to have ejected a cubic mile of ash during its single explosion, the noise of which was heard 500 miles away.



Courtesy New Zealand Government

WAIMANGU IN ALL ITS GLORY

When this geyser was in its prime, black mud and stones, as well as scalding water, were flung to a height of 1,500 feet. After a long period of rumblings and boilings, it has resumed activity, though not on its previous imposing scale (see Editor's note, page 109). The hut whose peaked tip is seen in the right foreground was 550 feet above the water before its removal to a safer location. Note the three men in the middle distance.

would first leap into action and proclaim its sovereignty.

Suddenly, in 1900, the outburst came. The quiet pool which lies within its crater was stirred, steam rose from its surface, and with no further warning the very bowels of the earth, as it seemed, were hurled through it into the air in one tremendous explosion.

Two men prospecting for ore in that uninhabited region saw the eruption and brought back the news that Waimangu had broken loose. New Zealanders henceforth could boast the greatest and grandest geyser in the world.

GEYSER TAKES TOLL OF THREE LIVES

It seems to have taken the people of Rotorua some little time to realize that, from the erratic and wholly ungovernable character of Waimangu, a near approach to its crater must at all times be attended with the greatest personal risk; for, although the explosions were soon found to come at average periods of 36 hours, irregular eruptions were of frequent occurrence and took place without warning, when least expected.

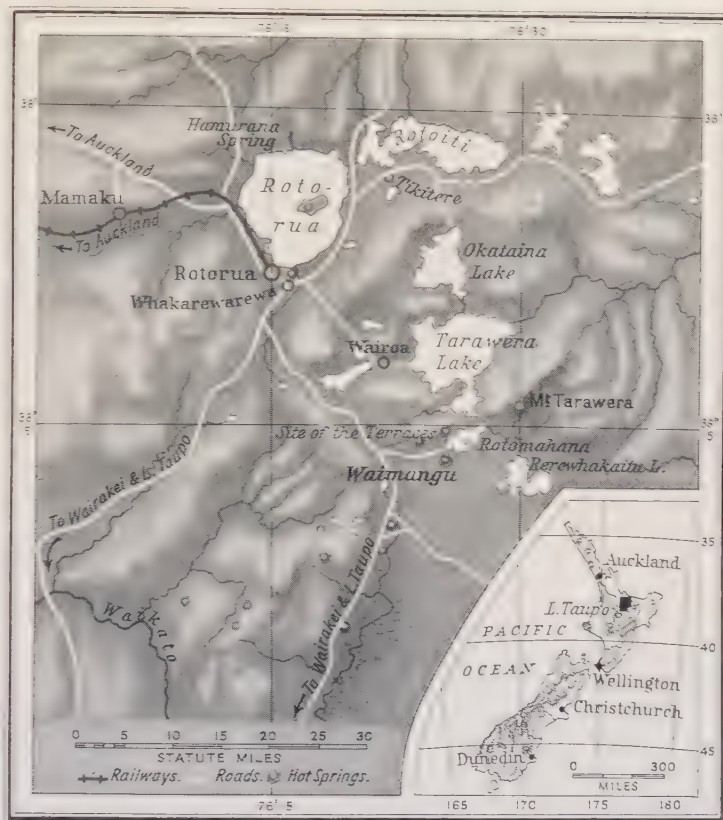
As is the law with all new dangers, somebody had to be hurt and sacrificed before steps were taken to prevent the ignorant and foolhardy from venturing too near.

In the summer of 1903 two girls and a guide visited the crater, and, though previously warned of the risk, they stood near the brink to secure a photograph at close quarters. An eruption occurred, the pond was thrown bodily into the air

to a height of some 1,500 feet, with enormous quantities of mud, huge rocks, and steam, and the unfortunate visitors were caught by the back flow of the boiling water and swept down into the crater, from which the bodies were later recovered, terribly burned and mutilated.

From that day the geyser basin was railed off in such a manner that nobody could approach near enough to incur the slightest danger.

It was but a few months before this mishap, in February, 1903, that, while staying at Rotorua, in the hot-spring district, my friend Mr. Bury Barry and I visited Waimangu. In those days the only warning of the risk of near approach was a small signboard affixed to a post



Drawn by Charles E. Riddiford

A MAP OF THE ROTORUA HOT SPRING REGION OF
NEW ZEALAND

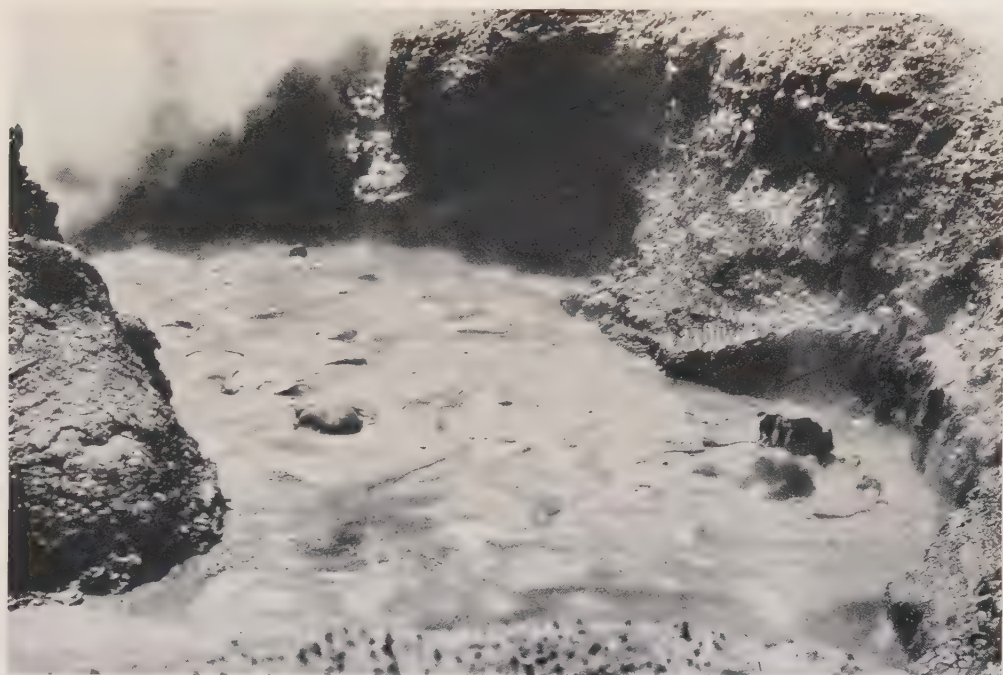
The black square on the North Island of the small inset map is the region shown in detail on the larger map. The eruption of Mount Tarawera in 1886 altered the face of this entire territory. It was not until 14 years later, however, that Waimangu came into action and established its preëminence among the geysers of the world (see text, page 109).



© F. G. Radcliffe

THE GREAT WAIRAKEI GEYSER IN ACTION

Fifty-two miles from Rotorua is an astounding locality crowded with a variety of thermal activities which cause the earth to quiver and throb. The show geyser of the Geyser Valley is the Great Wairakei, a hot-water regulator of Maoriland. It shoots from steaming cliffs encased by oxidized iron, and its gusher plays at a height of 25 or 30 feet.



Courtesy New Zealand Government

THE PORRIDGE POT AT TIKITERE

"The Devil's Porridge 'Pot' seethes and rumbles with some foul glutinous concoction" (see text, page 119), and is only one of the awesome features of Tikitere's numerous boiling mudholes, bubbling lakes of hideous colors, and hillsides erupting with steam blasts.

beside the path¹ leading to the crater, which said simply, "Danger Limit." All questions as to the magnitude of the risk and the advisability of approaching nearer were left to the visitor himself.

What could be more innocent-looking than this little pond, set deep down in the rocky basin between the hills? What more unlikely than that it should choose the very moment when one was leaning over its brink, to explode?

So people argued, and so visitors, like ourselves, continued to come and approach near to its edge, little knowing that within a few short months Waimangu, like the dragon of old, was to rise without warning and levy a toll of three human lives for the privilege of beholding it breathe forth its smoke and steam.

If I had fully realized at the time the greatness of the danger, I doubt if I should have taken a photograph, on the very edge of the crater, or have paused for some time to watch the steam and bubbles rising from the pool's surface (see illustration, page 112).

But Waimangu was propitious to us. Although it had worked the night before and we had been told that we could venture into its basin with impunity, it exploded marvelously just after we had left the danger zone and climbed the adjacent cliff. But I am anticipating. Let me first describe the approach.

PASSING OVER TERRACES OF SULPHUR

The road through the hills from Rotorua toward Waimangu led us over the most desolate country; in all directions only the lava-formed, rolling wilderness was to be seen. Occasionally we passed terraces of sulphur, silica, and alum, where jets of steam or boiling mudholes further attested the volcanic nature of the land. So far as any natural, earth-like features were to be seen, one might have been in the nether regions.

Then, after scrambling up a steep hill to the westward of Rotorua, a superb view suddenly appeared. At our feet lay the azure surface of Lake Rotomahana, of such a blue as one sees portrayed and



Courtesy New Zealand Government

GATES OF HELL AND THE INFERNO, IN THE VALLEY OF TIKITERE: ROTORUA

This valley is a sepulchral spectacle of horror and desolation, with sulphur-stained mounds and banks, pools of boiling mud, and nauseating steam. The thick ledge of silica known as Hell's Gate is the steam-blanketed entrance to Tikitere and overlooks two boiling, muddy pools. The Inferno is an ugly basin of splashing mud and odorous steam and is afflicted from time to time with furious convulsions.

believes unreal, a turquoise in an old-gold setting, for the encircling mountains were bathed in the yellow haze of afternoon sunlight and rose as tawny protectors of their charge below.

Grim and foreboding in the background stood Tarawera, passive now and smokeless, brooding over her dark deeds of bygone years, dreaming, perhaps, of the day when power would once more be given her to rise and strike the land with terror.

From the hill beside Rotomahana we descended to Waimangu's basin. The boiling pool which occupies the center of the crater, some 300 feet in width, was quite still except for the bubbles which rose to its surface and the thin steam drifting lazily upward.

We passed the danger line, threaded our way carefully between the boiling springs, and then, climbing down into the crater, stood finally on the brink of the pool itself. One cares to remain but a moment in such a position, for although Waimangu had exploded during the night

and was not actually due to work again for 36 hours, the thought of what would be our fate, should an irregular eruption occur, rendered the spot a peculiarly unattractive one and caused us to climb without delay back to the plateau, and on up to the cliff above the basin.

WAIMANGU GOES OFF

It was well that we did so. Scarcely five minutes had elapsed from the moment that we had stood within the crater. My camera was pointed down for a photograph from the summit of the cliff and I had made the exposure. Then, even before there was time to change the plate, the surface of the pool began suddenly to seethe. I heard Barry, at my elbow, shouting, "My God, man, the thing's going off!", but his voice was quickly drowned in the fearful uproar that immediately ensued.

Waimangu was in eruption. The formerly placid pond was shot, in one terrifying blast, into the air far above our



© F. G. Radcliffe

THE LAND OF NATURE'S FIRELESS COOKERS: WHAKAREWAREWA

At this ancient Maori village, a short distance from Rotorua, is a prodigious amount of hot mineral water. The houses are perched in flimsy fashion around, between, and sometimes upon, boiling springs and fumaroles. The thrifty, clever natives use these vents and springs as fireless cookers for their food, as washtubs, and for outdoor hot baths (see text, page 127).

heads—black water, black mud, black rocks; and, following them with the hissing of a thousand rockets and the roar of a thousand cannon, a burst of whitest steam quickly outstripped and enveloped the uprushing mass.

The explosion was awe-inspiring, terrible, grand beyond comparison. No more appalling, yet fascinating, spectacle can exist; no greater satisfaction can be experienced than to see such a phenomenon at close range. The sight is worth traveling thousands of miles over land and water to behold.

The outburst had taken place in the fraction of a second. Almost immediately we were pelted with the sand and small stones which fell, as the exploded mass shot back into its crater, causing us to take refuge in the shelter hut provided for that purpose on the summit of the cliff.

In a moment all was over; the pond regained its usual placid surface and no sign, save the continued shower of sand, told of the mighty eruption which had taken place. Silently we descended again to the basin, a little serious at the thought of what would have been our fate had the

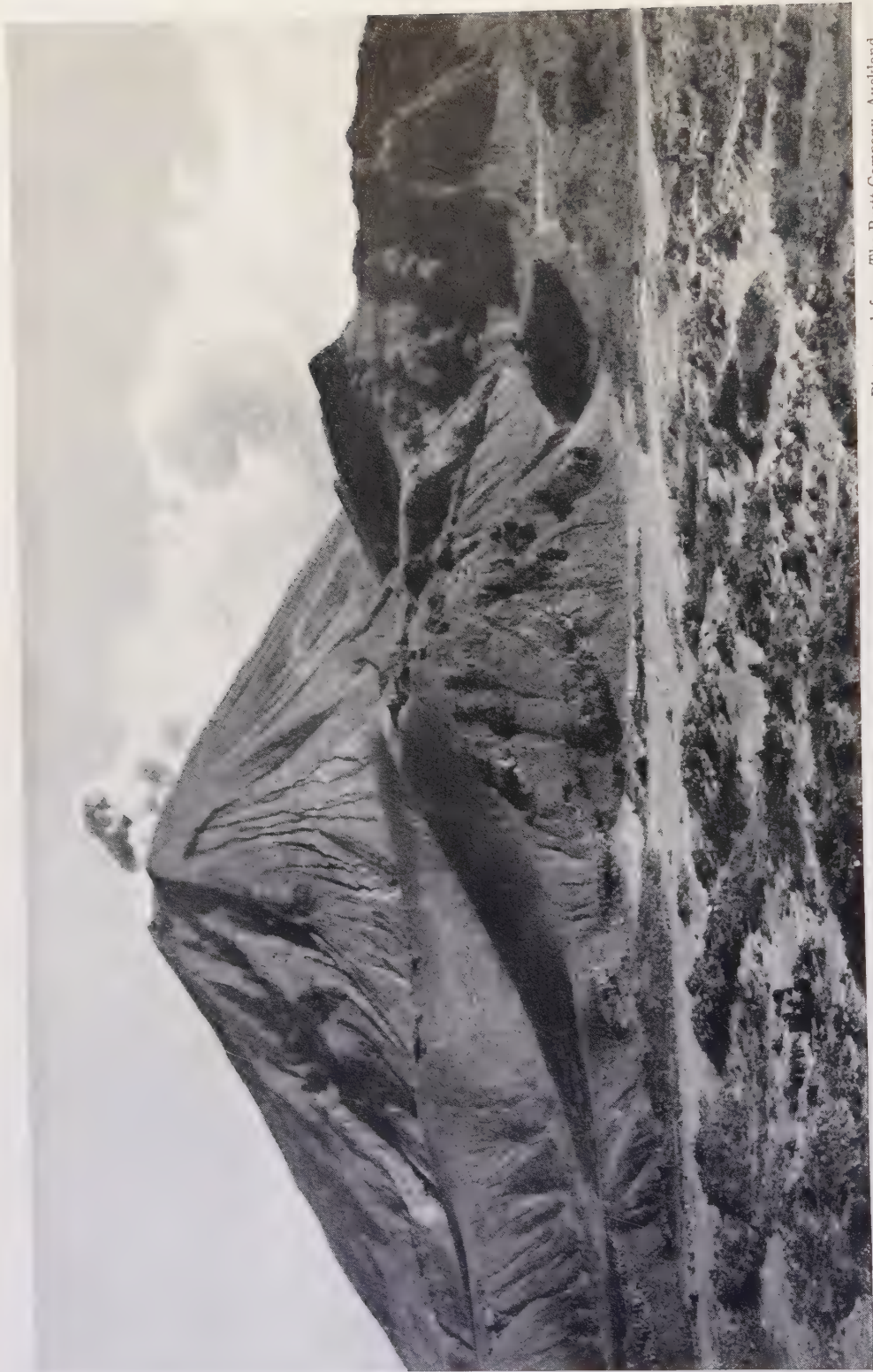
outburst occurred a short five minutes earlier. It is well indeed that visitors may now no longer approach within the zone of danger.

ROTORUA IS ONE OF NATURE'S GREAT
SANITARIUMS

Waimangu, though the greatest, is by no means the only feature which renders New Zealand a wonderland of never-failing interest. A bad attack of malarial fever, contracted in the jungle of the Malay Peninsula, took me down there one winter to try to get the poison out of my system.

It was a long journey—seven days from Singapore to Ceylon, three weeks more to Sydney, and a final four days to Auckland, whence the railroad brought me to Rotorua, in the hot-spring country.

If, after the long, lazy sea voyage anything remained necessary for my complete recovery, a few weeks in the clear and bracing atmosphere of New Zealand quickly accomplished it. Nor did I have to number myself among the many invalids who come to the hot-spring region for the wonderful curative powers of its mineral baths, since Rotorua is famous



Photograph from The Brett Company, Auckland

THE GAS-SWEPT SUMMIT OF NGAURUHOE

In Tongariro National Park, "a gift of burning mountains" made to New Zealand by a Maori chief, is Ngauruhoe, the youngest of the dominion's volcanoes. It is a symmetrical cone 7,515 feet high, with a crest occupied by a spacious crater containing two smaller craters. These vents discharge sulphuric acid fumes with much noise and force.

for its healing springs and baths of water, mud, and vapor.

If you are affected with gout or rheumatism, you will spend most of your time in the well-known "Priest's Water"; or, if something is to be desired in the smoothness of your skin or the loveliness of your complexion, the "Rachel" bath, according to tradition, will make you beautiful forever.

But, so far as combined benefit and enjoyment go, you will find more absolute pleasure by passing all your available moments in the big, hot sulphur swimming pool, where you can float lazily for hours at a time in water above 100 degrees Fahrenheit, and leave it feeling as vigorous and energetic as though newly wakened from a refreshing sleep.

FIRE AND BRIMSTONE

As the traveler approaches Rotorua a strange, unearthly smell of sulphur fills the air; white puffs of steam rise, for no visible reason, from green hills and valleys; huge mudholes by the roadside seethe and bubble like porridge in a caldron; hot lakes of extraordinary colors—yellow, blue, pink, green—and brilliantly colored strata along the mountain sides make you stare and rub your eyes to be sure that such apparent unrealities exist.

Your nearest conception of an orthodox hell will be truly realized when you enter the Valley of Tikitere, some ten miles from Rotorua. The earth is hot beneath your feet, the country gapes with steaming cracks, and if a cane is thrust a few inches into the soil a jet of steam or a spout of boiling water reminds you that, just beneath, the very bowels of the earth are seething toward the surface.

You are surrounded by an inferno of boiling mudholes, bubbling lakes of hideous colors, and blasts of steam issuing from the hillsides with the regular exhaust of powerful engines.

Follow the guide closely, for a single misstep may land you in some loathsome abyss, and there are pleasanter ways of reaching eternity.

Here, the guide points out, are the "Heavenly Twins," two horrid bubbling mudholes side by side, one of which boils the thickest of brews, while its twin contains the thinnest. On one side "The

Devil's Porridge Pot" seethes and rumbles with some foul glutinous concoction; on the other you look down through the "Gates of Hell" into a slimy lake, whose thickened waves rise and recede, as if about to break upon the banks above, and whose sulphurous fumes send you back, gasping for a breath of pure air (p. 116).

FROM AN INFERNO TO A VERNAL PARADISE

But heaven and hell rub elbows in this country. Let's have a look at some of its more cheerful features. We will leave behind the boiling mud, uncanny jets of steam, and sulphur-laden air, and cross over to Rotorua Lake, where the fresh breeze washes the poisonous fumes from our lungs and cools our skins from the burning breath of those horrors behind.

A small steamer carries us across the rippling lake, dotted with the white sails of Rob Roy canoes and knockabouts, passes between green islands, and lands us in thick woods on the opposite shore, where we enter a rowboat and proceed lazily up an enchanted river to a fairyland of extraordinary beauty. The banks are thickly grown with great, overhanging trees, blossoming shrubs, ivy, and tall ferns, which shade marvelously clear depths of opalescent color.

Suddenly the river narrows, turns, and stops short, cut off and walled in by the same luxuriously wooded banks. For a moment we are astounded that a flowing stream should come so suddenly to an end, until we look over the boat's side and see far below, through the transparent water, a jagged opening in the bed of the stream, from which great quivering volumes of ice-cold water well up to the surface, glancing with rainbow colors and shot with arrows of crystal light.

Now we see the cause, for this is the famous Hamurana Spring, the source of the beautiful river, which flows full grown from this hidden wooded spot down into Rotorua Lake—a spring from which 5,000,000 gallons are poured forth every 24 hours. Looking into its depths, we can see delicate shells, and ferns growing far below, which, from the perfect transparency of the icy water, appear almost within reach.

The force of the uprushing torrent is so tremendous that coins which are



© International Press Photo Co.

A NATURAL SULPHUR FACTORY: WHITE ISLAND

This isolated, seagirt crater lies 27 miles from North Island's mainland, in the Bay of Plenty. It is a bed of hot sulphur, whose crusty, treacherous surface breaks under the visitor's feet and whose acids eat up shoe soles and clothing. The island's shores are difficult of approach and it is often necessary to wait for a favorable sea.



© F. G. Radcliffe

WHANGAREI FALLS, NORTH AUCKLAND

Luxuriant and perpetually green forest settings frequently enhance the beauty of many of New Zealand's scenic charms. The trees are usually tropical rain-forest types, massed here and there with brilliant flowers. The forests are also distinguished by a wealth of tree ferns, filmy ferns, lianas, massive perching plants, and mossy carpets.



Photograph from A. S. Graham, Wairakei

THE TWINS GEYSER IN A DORMANT MOOD

The Twins are two gushers playing from the same pool. The stronger bursts explosively; the other, sounding like a paddle wheel, plays less frequently. Wairakei's famous valley has many medicinal hot springs, but is most noted for its beautiful, fantastic geysers, some of which are always playing for the visitor.

thrown in will remain suspended halfway to the bottom, and finally drop to one side of the spring, where they lie glittering below.

The Maoris, who are expert divers, have tried again and again to reach this tempting store of treasure, but have never succeeded, except by working in pairs. One man jams a pole into a crevice. His companion, grasping the pole firmly, is thus enabled to withstand

the force of the water as he descends. We will pass half a day and have luncheon near this beautiful spot, and then, in the afternoon, ride over to the geyser region of Whakarewarewa, a small Maori settlement on the other side of Rotorua.

The country here is less fearful than at Tikitere, but none the less active for all that. Within a radius of less than 100 yards, some ten or twelve geysers play at intervals ranging from two minutes to



© International Press Photo Co.

A MUD VOLCANO IN THE WAIOTAPU VALLEY

Over the scrubby surface of Waiotapu, 21 miles from Rotorua, run hot-water creeks, and early on a frosty morning the visitor sees steam columns, rising like fog from a swamp, ascend in every part of the valley. It contains the largest mud volcano in the thermal district. Cliffs of pure yellow sulphur and beautiful terraces of silica are also to be seen in this region.

several hours, and the display, when several of them happen to be in action at the same time, is most effective.

SOAPING A SLUGGISH GEYSER TO MAKE
IT SPOUT

When Waikite, the famous twin geyser, ceased working it was succeeded as queen of Whakarewarewa by Wairoa, but even Wairoa plays no longer of her own accord. Only under the inducement of a

plentiful supply of soap does she consent to perform for the curious multitudes.

As is well known, too much soaping of a geyser causes it eventually to cease its action altogether, so that the practice becomes an important ceremony. In the Rotorua thermal country it is allowed by the government only when some distinguished visitor comes to see the display.

I was fortunate in being on hand when Wairoa was thus induced to play for the



Photograph from The Brett Co., Auckland

YACHT-RACING IN RANGITOTO CHANNEL: AUCKLAND

Rangitoto Channel, lying between the mainland and the volcanic island of that name, is the principal approach to Auckland's spacious harbor. In fact, the city has two harbors, one communicating with the Pacific, the other with the Tasman Sea. The numerous bays and inlets of the first form a paradise for yachtsmen.



Courtesy New Zealand Government

WOMEN POI DANCERS AT MAKETU

The *poi*, or canoe, dance is performed by a number of girls. The movements portray the launching of a canoe; its buffeting, tossing, and capsizing by a storm; its righting and triumphant progress over the waves, ending with its safe arrival on the beach. To suggest the sound of the paddle stroke, each dancer twirls and strikes together two poi balls, made from the leaves of the *rauipo* (a common cat-tail or reed mace), to which a flax cord is attached. The stripped-flax dancing skirt makes a sound like that of water lashing against the bows of a canoe.



Photograph by Dr. Carlos E. Cummings

A GREETING IN THE APPROVED MAORI FASHION

In the *hongi*, noses are pressed, rather than rubbed, gently from side to side and right hands are clasped. At family reunions or at parties the *hongi* is prolonged and, after lengthy separations, it is accompanied by tears and moans. These little girls are standing against a background showing a Maori carved slab and other designs of native house decoration.



Photograph from Herbert E. Gregory

THE LATE KING MAHUTA SPEAKING AT A MAORI COUNCIL

The Maoris are proud of their right to vote and of their membership in the New Zealand Parliament. Though subject to the dominion's laws, they are governed in great part by their own chiefs. Most of the native men and women now wear European dress.

son of a former premier of New Zealand. The wooden cover, always padlocked over its mouth, was solemnly removed, the crowd warned to stand back out of danger, and a bag of bar soap thrown into the diminutive crater.

Almost immediately the water foamed, lathering up to the edge of the siliceous opening, but not until almost 20 minutes later did the actual playing begin. There was a deep rumbling below, a choking, gurgling noise came from the depths of the crater, and, with a last grand roar, Wairoa shot into the air, full 130 feet, a graceful, slender column of whitest steam and water, breaking at the top into silvery feathers which drooped, dissolved, and drifted off into the sunlight.

NATURE'S MATCHLESS FIRELESS COOKERS

If it should occur to anyone to wonder why a town like Whakarewarewa should be built in the midst of this hot-spring terrace, with boiling pools between the very houses, and steaming holes scattered about so plentifully that a visitor must

look pretty carefully where he walks lest he disappear into one of them, the answer is almost too obvious. The Maoris are a thrifty race; coal and firewood are expensive; stoves rust and kettles require tending. Then why go to superfluous expense and trouble, when Nature has supplied not only fuel but stoves in the form of constantly simmering kettles, all as free of charge as sunlight and fresh air?

Here, at the very doors of the natives, these steam holes, or fumaroles, are at all times ready for use. Over the openings are placed small, slat-bottomed boxes; the food to be cooked, wrapped in leaves, is placed within. Soon an appetizing smell announces that dinner is ready (p. 117).

If other domestic cares delay the dinner hour—if the father of the family is late, or the baby has fallen into a mud bath and requires a precipitate change of garments—no penalty is imposed in the way of a burned meal; for, the stew having been cooked and the soup boiled, they simply remain there, as in an oven, keep-



Photograph from The Brett Co., Auckland

MAORI WOMEN'S CANOE RACE: NGARUAWAHIA

This former capital of the Maori Kingdom, at the junction of the Waikato and Waipa rivers, holds a picturesque Maori carnival once a year. On St. Patrick's Day thousands of natives and sight-seers gather to view races between war canoes, canoe hurdles, stirring war dances by the men (see page 129), and the graceful poi dance (see page 125) by the women.

ing nicely hot, but suffering no extra scorching as a result of the delay.

And as for the Monday clothes washing, why, it is simply a question of kneeling beside one of the big hot pools and sousing the garments until they are as white and clean as new. True, both clothes and dinner may savor more or less strongly of sulphur; but who so fastidious as not to be able to cultivate a taste for sulphur as easily as for any other spicy flavor?

The Maori, I say, is of a thrifty race; yet that is the least of his attributes. No brown man possesses more personal and national pride, more true dignity, fearless bearing, honorable and faithful instincts, and cheeriness of temperament. There is no fawning, no bowing and scraping, in his attitude toward the colonizers of his country, and all his dealings are marked with straightforward manliness.

Mentally he is keen, physically superb. I know of no more stirring sight than the *haka* war dance, in which the most pow-

erful men of a village, stripped to the waist to give better play to their great muscular arms and bodies, form in even ranks, and, taunted with cowardice in pantomime by their women, commence muttering in deep voices, wave their arms and twist their bodies in fierce unison, as though writhing under the bitter insults.

The taunting continues, the muttering, growing louder and more ominous, becomes a roar; slowly they work themselves up to a tremendous pitch of excitement, bellowing more and more threateningly, swaying and twisting with greater and greater fierceness, till the onlooker becomes positively terrified in spite of himself.

Then, suddenly, with a last grand shout, they break their ranks and dash headlong to meet the imaginary foe.

THE WOMEN ARE LITHE AND GRACEFUL

The women are no less dignified and proud of bearing than the men and exhibit a grace of movement and liteness



Photograph from H. E. Partridge

MAORI WARRIORS REHEARSING A HAKA (SEE ALSO TEXT, PAGE 128)

In the rendering of a *haka*, or war dance, the Maori wears a kilt of flax, stripped and dried. Some of it is scraped at intervals, so that the textures, alternately stiff and soft, permit flexibility during the various agile movements of the dance. The weapon brandished by these warriors is the *tewhatewha*, which is about four feet long. One end has a point, the other a hatchet-shaped blade. It is said to have been used by the leaders. These warriors fought against the British in the conflicts between native and settler from 1861-1871.

of body unknown in any but South Sea races. Were it not for the tattooing of the lips and chin after marriage, many of them would be extraordinarily beautiful.

Their speech, as is that of the men, is delightful to hear, since it totally lacks the harsh, guttural tones of the Arab and Hindu. Their history is full of folklore, handed down from age to age, every landmark and custom having its own particular myth.

Some of their customs are very amusing, and one can scarcely repress a smile to see the women saluting their friends in the street by rubbing noses. They carry the babies slung upon their backs, as do our Indian squaws their papooses. Indeed, in the Maori, one is constantly reminded of the American Indian.

HIGH CARNIVAL AMONG THE MAORIS

On Rotorua Lake, once a year, high carnival is held. From all the villages of the surrounding country come the Maoris

with their babies, tents, pots and pans, to camp on the shores of the lake and make merry after the fashion of all nations and all ages.

There is foot-racing on the beach, yacht-racing on the lake, and horse-racing on the track behind the town, but what delights the Maori heart above all else is the great race between the representative war canoes of the various villages, which takes place on the last day as the crowning event of the celebration.*

It is a fine sight to see these great canoes, manned by from forty to fifty stalwart men, paddled like mad across the big lake for the honor of their respective towns.

The captain of the crew stands in the center to give the stroke; the men, all in uniform, keep the pace with a dash and

* See also "Hurdle Racing in Canoes: A Thrilling and Spectacular Sport Among the Maoris of New Zealand," in the NATIONAL GEOGRAPHIC MAGAZINE for May, 1920.



Courtesy New Zealand Government

A MAORI BELLE IN NATIVE DRESS

Many of the younger girls are beautiful, since they do not mar their looks by tattooing their lips and chin, according to the ancient fashion. They are especially proud of their long, luxuriant hair. The Maori boys and girls of to-day have lost interest in their native songs and legends and enjoy modern dances and motion pictures.

snap worthy of tried athletes, and great is the rejoicing over the winners.

"THE CHASE FOR A MAORI BRIDE"

Then there is the *Ha Kahaka Tamahine*, which, being interpreted, means "The Chase for a Maori Bride." The selection of the young maiden, or *wahine*, for this event is no easy task, for she must be the most beautiful of all the girls in the surrounding country, and beautiful Maori girls are the rule, not the exception.

The lucky maiden is put in the bow of a small, very swift canoe and her brother

or some other relative takes his place in the stern to paddle her through the chase which ensues. As they appear on the course before the crowds who throng the beach, a tremendous cheer goes up, and it is not difficult to see that this happy little *wahine* is popular as well as lovely.

Hardly have the *wahine* and her relative taken their places near the starting post when the canoes of the chasers shoot out to their respective stations. Each is very fast and light and paddled by five or six men, with a vacant place in their midst for the bride, in case she is captured before reaching the finish line.

At the signal, the bride's canoe dashes away down the course, followed a minute later by her pursuers. The object of the chase, as is soon evident, is to overtake the maiden, lift her from her own craft into one of the places left vacant for her in the canoes of the contestants, and carry her over the course to the finish line.

The crew which makes the capture at once becomes the object of pursuit for the others, who in turn try to overtake the bride.

The crew which finally succeeds in carrying her across the finish line is proclaimed the winner; but whether or not the lady chooses her husband from the winning boat is a delicate question, which does not, I think, enter into the conditions of the race itself. At any rate, the bride is landed on the beach and has to run a gauntlet of deafening applause from enthusiastic thousands.

Our stay at Rotorua must, like all good things, come to an end at last. Rising very early one morning, we take a regretful leave of the mist-wrapped lake and the steaming terraces and hillsides, whose beauties and horrors alike have been a source of such keen interest; we are whirled off over the lava-roughened hills, past Waimangu, past old Tarawera, and so down through the fern-clad jungles to Wairakei, Lake Taupo, and the Wanganui River, where new scenes of undreamed-of beauty await us in this imperial wonderland.

TRIPOLITANIA, WHERE ROME RESUMES SWAY

The Ancient Trans-Mediterranean Empire, on the Fringe of the Libyan Desert, Becomes a Promising Modern Italian Colony

BY COLONEL GORDON CASSERLY

INDIAN ARMY (RETIRED)

ON a low, sandy promontory of the North African coast stands the white city of Tripoli, capital of Tripolitania, the western province of the Italian colony of Libya, which lies between Tunisia and Egypt (see map, page 138).

As the traveler approaches from the sea, the tall, slender minarets of the city's numerous mosques, rising high above the flat-roofed houses of the native town and the newer buildings of the European quarter, and its setting of white sand dunes and green oases of palm groves and gardens give it a more truly African aspect than its sister cities of Tunis and Algiers.

Yet, when the steamer rounds the mole and enters the spacious new harbor, the stone-embanked esplanade, with ornamental balustrade and tall electric-light standards, and the large, modern buildings beginning to fringe the broad promenade, have nothing that is not European, except the Moorish style of architecture of the new and imposing Grand Hotel. Even the storied old castle in the center of the esplanade is not Eastern, although for centuries Arab beys and Turkish viceroys, having turned the Knights of Malta out of it, lived there in state.

In 1911 the Italian flag replaced the crescent and star, and Rome of To-day took back the city that, from the fall of Carthage to the coming of the Vandals, had acknowledged the rule of Rome of Yesterday.

THE OCCIDENT ELBOWS THE ORIENT ON TRIPOLI'S MAIN STREET

But only the sea front and the first two streets behind it are modern. The remainder of Tripoli looks much as it did before its latest conquerors landed.

Even in the principal street, lined with

cafés, banks, the post office, governor's palace, shops, and offices, strings of camels lounge disdainfully past automobiles. Arabs and Negroes, wrapped in the universal dingy white woolen shroud called *barricano*—the burnous is seldom worn—shuffle by groups of smart Italian officers in khaki and silver and Fascisti in black shirts and caps. Arab and Negro women, with only one eye peering from beneath an all-enveloping cloak, use that eye to stare at the short skirts and silk stockings of European ladies. Thus East and West meet.

CHANGING THE GUARD IS A PICTURESQUE CEREMONY

The main street continues beyond the massive stone bulk of the castle, whose exceedingly high walls tower above all other buildings in the town, old and new, a reminder that in times past its lord held his subjects in the hollow of his hand—and in the fear of his guns!

The castle suffered in the bombardment by the Italians in 1911, but its new masters have restored it. It is no longer a citadel, but a relic, and now contains the office of the governor, the headquarters of the police, and some other public departments, lodged high above the city, in quaint arcaded courts (see page 132).

But its gates are held by soldiers, white, black, or brown, according as an Italian regiment, a Negro battalion from Eritrea, or an Arab corps recruited in Tripolitania furnishes the guard for the day.

At the main portal opening on the principal street an interesting military ceremony takes place every afternoon (page 136).

From afar is heard the harsh notes of brass trumpets, the roll of drums, and a weird wailing, as of bagpipes. Down the street, headed by a band, comes a



Photograph by Gordon Casserly

THE OLD CASTLE: TRIPOLI

This stronghold has had a part in the making of history for many centuries. In 1551 the Turks took it from the Knights of Malta and Turkish viceroys, and Arab beys later lived there in state. In 1911 the Italian flag replaced the star and crescent. The once great citadel is now used to house some of the provincial government offices.

small column of troops. They belong to a *battaglione libico*—that is, a battalion of Arabs of this Tripolitanian province of Libya.

They are dressed in a dark-brown shade of khaki, with black-tasseled red fezzes, and their leather belts are buckled over broad, woolen cummerbunds of a regimental pattern of tartan, green, yellow, red, blue, or some other blending of colors that would astonish a Highlander.

The instruments are short reed flageolets, which sound not unlike the Scotch pipe, but are without the drone; nor, to the untrained ear, does the Arab music played on them seem very different from that of the bagpipes.

Behind the pipers come drummers, followed by trumpeters with long brass instruments, on which, in turn, is blown a bugle march. A company color standard, borne aloft, heads the men of the main guard behind the musicians.

The sentry at the castle gate is a trooper of an Arab cavalry corps. He wears a white cotton uniform, pale-yellow zouave jacket, and a red fez. As the column ap-

proaches he turns out the guard, which falls in on one side of the gate.

The band wheels into place beside it, and the new guard halts, facing the old guard. Arms are presented, the trumpeters blow "The Salute," and the band plays the Italian national anthem, at which soldiers and civilians passing by halt, stand at attention, and salute. Even carriages stop and ladies in them stand up.

Then the hymn ceases, all pass on their way, the guards change over, and the one relieved marches off behind the band.

This day both detachments have been of the Arab corps. To-morrow the relief may be men of an Italian infantry regiment (p. 136), or of an Eritrean battalion of tall, thin, black soldiers with high red fezzes and gay-colored tufts on top, khaki uniforms, puttees, and bare feet.

A PLUNGE INTO ARABIAN NIGHTS

Away from this main street, one plunges into the Arabian Nights. Here an arched entrance leads to a narrow, roofed alley, with apertures in the top for light. On either side of it are dark, cavernlike



THE NEW SEA PROMENADE: TRIPOLI

This seaport was once a stronghold of those fierce Barbary pirates who for centuries proved a scourge to the shipping of the Christian world. Their depredations to American commerce finally brought on war, and it was here, in 1804, that Commodore Decatur recaptured and burned the American frigate *Philadelphia*, which had gone on the rocks and been taken by the pirates.



Photographs by Gordon Casserly

THE WATER FRONT OF TRIPOLI WITH A GRACEFUL MINARET IN THE DISTANCE

Under the Turkish régime the many mosques of Tripoli were jealously closed to the unbeliever. Now, however, it is possible to visit many of them, one of the most interesting being the Mosque of Dragut, burial place of the pirate of that name, whose chief claim to fame was that he provided the material for and built a mound of Christian skulls by the seashore at Djerba.



Photograph by York and Son

THE CITY GATEWAY: TRIPOLI

The metropolis of Italian Libya was probably founded as a trading post by the Phoenicians of Sidon long before the Christian Era. It has been held in turn by Carthaginians Numidians, Romans, Vandals, Byzantines, Arabs, Berbers, Normans, Spaniards, and Turks. It now renders allegiance to the King of Italy.



Photograph by Gordon Casserly

THE ARCH OF MARCUS AURELIUS: TRIPOLI

The remains of this noble white marble monument to ancient Rome's philosopher emperor stand on a street near the harbor (see text, page 149).

openings, in each of which sits a native at a hand loom, weaving scarfs or long pieces of silk striped in bright colors.

Near by is a similar arcade, in which each cave is filled with Oriental carpets, rugs, and round leather cushions with gay designs. Only one of the sellers is modern enough to invite a passing European to inspect his stock; others recline silently at their ease, waiting, like true Easterners, for customers to come to them.

Out of the darkness of these arcades one passes into the brilliant sunshine of a narrow lane of dull, two-storied white-washed houses. Only the door and one or two tiny, barred windows break the blankness of their walls.

One half-open door gives a glimpse of a square courtyard inside, with pillared arches supporting a gallery on which all the rooms open, well lighted by windows looking on the sunny court. From the outside one would never suspect the brightness of the interior of these Arab houses.

Along the narrow alley lurches a silent-footed camel, laden with bulky bales of

wool, which almost touch the sides of the lane and force passers-by to take refuge in doorways.

Everywhere is a maze of similar streets. The majority are lined with dwelling houses, in some of which larger windows on the front and an occasional balcony show where a poor Italian or Maltese family lives among the natives.

But there are a few shops. Here is one selling vegetables. Its Negro owner dozes among baskets of carrots and cabbages and pumpkins of incredible size, almost big enough for Cinderella's coach.

CAFÉ PATRONS SQUAT ON THE FLOOR

Farther on is an Arab café, merely a dingy room lighted only by its door opening in the lane. Inside, a brick fireplace has a pot of coffee boiling on a handful of charcoal. A lean Moslem dips the thick, black liquid out with a long-handled measure, from which he pours it into tiny cups handed by a dirty-faced boy to customers squatting on mats on the floor.

A grating, grinding noise. Through an open door one peers into a dark, low-



GUARD MOUNT BEFORE THE CASTLE GATE: TRIPOLI

The changing of the guard is a colorful ceremony, accompanied by blare of trumpets, roll of drums, and the shrill, weird wail of flageolets (see text, page 132).



Photographs by Gordon Casserly

THE PRINCIPAL STREET OF THE NEW EUROPEAN QUARTER OF TRIPOLI

This thoroughfare has little about it to suggest the East. The broad pavements, electric lights, telephone wires, and thoroughly modern governor's palace, in the left foreground, bespeak the extent to which this section of Tripoli has become Italianized.

ceilinged room on the street level. Round and round stalks a camel, a piece of sack- ing tied across his eyes. He is harnessed to a long beam, turning the millstones in the center of the room, which grind the grain dropped into the hopper. The flour pours out on to a cloth on the floor, from which a man from time to time scoops it up. Mechanically, undriven, never stop- ping, the blindfolded animal stalks round its dungeon.

In the next lane a brawny Negro baker sits beside a large oven which occupies the entire front of his shop. Jewish chil- dren squat on the ground before him, each with a small board. On some of the boards are lumps of dough ready for the oven, while others are empty, ready to receive the baked loaves. To-morrow is the Jewish Sabbath, and here the bread for it is being baked. At intervals the baker gets up, opens the oven door, thrusts in a long-handled wooden spade, and brings out a couple of crusty loaves. He hands them to a waiting child, then puts in a few more lumps of dough (see illustration, page 150).

ARAB WOMEN ARE SELDOM SEEN IN
THE STREETS OF TRIPOLI

Hardly ever is an Arab woman to be seen in any of the streets. An occasional fat old negress, to judge by the color of her hands, ankles, and bare feet—not an inch of skin being visible around the one eye showing between the gathered folds of the striped black-and-white cloth shrouding her head and bulky figure—waddles by or stops to bargain at a shop.

Around the next corner is the Jewish quarter. A stranger would hardly realize the fact at first, for all the men wear the Moslem red fez. But in the doorways stand groups of gossiping women with faces exposed to view, a proof that they are not Mohammedans. They are Jew- esses, descendants of managers and em- ployees of trading stations established here by the Phoenicians a thousand years before Christ, or of refugees from fallen Jerusalem.

They are surprisingly light-complex- ioned, much fairer than many of the Sicilian and Maltese women living around them. When young they are often quite pretty, but with advancing years they are apt to get very fat.



Photograph by Gordon Casserly

AN ARAB SOLDIER

Italy is turning to good account the martial instincts of the restless sons of the desert. They constitute an important factor in the main- tenance of order in Libya.



Drawn by Charles E. Riddiford

A MAP OF ITALIAN LIBYA

This flourishing colony of modern Rome is divided into four zones. The first is the sandy, undulating coastal plain, with many rich oases, and cultivable everywhere because of the never-failing supply of underground water at from 60 to 150 feet. The second is the low mountain chain called the Jebel. The third zone is inland desert, and beyond that the irregular tableland, seamed with deep beds of long-dry rivers, at present unoccupied by the Italians.

Nowadays, some of the richer and more modern Hebrew families have adopted European dress and ways. At receptions and balls in the Club of Jewish Youth their girls, in smart toilettes, dance the fox trot and one-step with Italian officers, and with young men of their own race in dinner jackets or lounge suits.

But the majority of the Jewish women in Tripoli retain their picturesque Eastern garb, and on the Sabbath the dingy alleys are enlivened by vivid hues. They wear loose-sleeved, short bodices of pink, blue, white, or some other cheerful color and straight-hanging silk skirts, white, striped black-and-white, or of even gayer tints (see Color Plate III). Their dark hair

is bound in bright silk kerchiefs. Many go barelegged and thrust their feet into heelless slippers, but some adopt silk stockings and smart, high-heeled shoes.

The men have more typically Jewish features and wear Oriental dress—red fez, long shirt hanging outside the trousers, a sleeveless, open waistcoat, and perhaps a long, black, single-breasted coat reaching below the knees, with bare feet in heelless slippers, or in socks and European boots (see page 151). Outside Tripoli many Jews are in garb indistinguishable from that of the Arabs.

As in Morocco, many of the trades are almost exclusively in Jewish hands, such as iron-working, cobbling, making jew-



Photograph by York and Son

A VAULTED STREET IN TRIPOLI

In a land where the fierce rays of the sun beat down with merciless intensity, these vaulted thoroughfares provide a degree of shade not to be disdained. To the right and left, in dark alcoves, are the shops of native merchants (see text, pages 132 and 135).

elry, and working in precious metals. Agriculture and stock-raising are left to the Arabs and Berbers.

TRIPOLI'S NEGROES PERFORM ANCIENT DANCES AT THEIR OWN MOSQUE

As in Morocco, the Jews are desirous of education for their children and have some good schools. I noticed the boys of one of these walking two and two through the streets, garbed in a close imitation of

the Italian naval officer's uniform—their school dress.

There are many Negroes in Tripoli, descendants, as a rule, of slaves brought originally from the Sudan. Owing to much intermarriage with the Arabs, they have lost their distinctive facial features, but retain their color and characteristic hair. Despite the intermingling and the adoption of Arab dress, they hold to some of their customs and celebrate their feasts

with the same dances performed by their race in the Sahara and Sudan to-day.

On the sand dunes outside the new walls of the city stands the Negro mosque, where I witnessed one of their festivals. As I approached the white-domed building several Negroes, wrapped in the universal barricano (see text, page 131), rode past me on bicycles and stacked their vehicles on the open ground before the mosque, where most of the black population of Tripoli, male and female, had gathered.

In an open space in the center of the crowd were planted two colored flags on staves tipped with brass balls surmounted by star and crescent—holy banners, these, to be carried in processions. Near by a group of men, in red fezzes and colored waistcoats over white garments, was dancing to music made by an orchestra of large hand drums similar to tambourines.

From time to time some of the dancers dropped out, exhausted, and others rushed in to take their places.

At the conclusion of the dance the women, with faces for once exposed, gathered together. Most of them were fat, many were old. Some had a magnificent display of gold and silver jewelry around their necks, in their ears, and on their ample bosoms. Their fingers were covered with rings, and broad bracelets adorned their arms almost up to the elbows.

They passed into the courtyard, and emerged later to form around the flags. Two of their number pulled the banners out of the sand, shouldered them, and marched off, behind musicians, to the city gate, followed by the other ebony ladies wrapped in voluminous white or black-and-white striped cloaks. A few were too superior to walk in the procession and hired victorias to take them back (p. 152).

All night parties of Negroes marched about the narrow lanes of the native quarter, and the drumming and shouting were kept up until dawn.

TRIPOLI PRAYS IN MANY MOSQUES

Tripoli has many mosques, each with its distinctive, graceful minaret, generally tipped with green tiles. Five times each day—at dawn, noon, vespers, sunset, and

evening—the tiny figures of the muezzins pass around the gallery of the slender spires and lean over to give in high-pitched voice the call to prayer.

The roofs of Tripoli's mosques differ from the usual model in not having the conventional large dome. Instead, they are flat, with a number of very small cupolas rising in lines.

The principal mosque belongs to the family of the Caramanli, formerly the rulers of Tripoli. Under the lengthy portico of the outer wall along the street, a number of men sit all day. They make the white, round caps worn here by the poorer Moslems instead of the fez, which, being manufactured in Europe, costs more.

The gate in the wall leads into a courtyard with a cloister running down the sides of the sacred building. One portion is railed off and filled with tombs of past generations of the family, those of men being marked by the carved turban crowning the headstone.

In a corner of the court rises the tall, slender minaret, with an inner stair winding up to the gallery, which furnishes a fine view over city, dunes, oases, and sea. Near the base of the minaret is the ablution basin, where Moslems perform the ritual washing before entering the mosque.

The interior of the sacred fane is many-pillared, lofty, and imposing. The high *minbar*, or pulpit, with its marble balustraded flight of stairs, is a gem of artistic carving, inlay, and mosaic.

Beyond the Jewish quarter lies part of the old city wall, allowed to stand as a historical relic on the sea front past the harbor; between it and the rock-studded water runs another long, balustraded promenade.

The ancient rampart was replaced after the Italian occupation by a much wider loopholed and bastioned stone wall, cutting off the sandy promontory on which the city is built. It incloses a far greater space and includes an oasis of vegetable gardens and palm trees, watered by many wells (see illustration, page 156).

But the gates now stand open and unguarded day and night, for during the last two years the valor of the Italian and

UNDER ITALIAN LIBYA'S BURNING SUN



Autochrome Lumière by Luigi Pellerano

© A SPAHI, OR NATIVE CAVALRYMAN, OF TRIPOLITANIA

In maintaining their control over Libya, the Italians employ Arabs, Italian infantrymen, and black soldiers from their colony of Eritrea, on the Red Sea. Note the wide stirrups and high pommel of this cavalryman's saddle.



Autochrome Lumière by Luigi Pellerano

VEILED MEN OF THE SAHARA

As a protection against sun and sand, the Tuaregs wear a face cloth, which is seldom removed. Even the Arabs, to whom the veil is not unknown, call these Berbers from Murzuk, "People of the Veil." Nobles wear blue face cloths and the lower classes wear white. Note the curious Tuareg saddles.

©



Autochrome Lumière by Luigi Pellerano

YOUNG WOMEN OF TRIPOLI IN HOLIDAY DRESS

Among the 60,000 inhabitants of Tripoli, seaport of the sand sea, there are more than 8,000 Jews. Most of the Israelitish women retain their Eastern costumes—their dark hair bound in bright silk kerchiefs; short, loose-sleeved bodices, and straight-hanging, striped silk skirts. They go barelegged, their feet thrust into heelless slippers.



A SOLDIER OF ITALIAN LIBYA



©

Autochromes Lumière by Luigi Pellerano

THE GOVERNOR'S BODYGUARD IN TRIPOLI

Once the home of the Barbary pirates, Tripolitania now relies upon the development of its pastoral and agricultural lands through the protection afforded by Spahi police.



©

Autochrome Lumière by Luigi Pellerano

ONE OF ITALY'S BATTALIONS IN LIBYA

The mixed character of Tripolitania's population is reflected in the make-up of the native battalions. Berbers and Arabs, Negroes from the Sudan and Turkish descendants of the Janizaries have all left their impress on these colonial troops. The black-tasselled red fez and the broad woollen cummerbund (sash) of its particular regimental pattern—tartan, yellow, green, red, or blue — are picturesque features of the uniform of each *battaglione libico*.



©

Autochrome Lumière by Luigi Pellerano

A MOHAMMEDAN PRIEST OF TRIPOLI

The Imam is a guide or leader of his people. He also conducts the Friday service of prayer and sometimes delivers a short sermon.



©

Autochrome Lumière by Luigi Pellerano

A DAUGHTER OF THE LIBYAN DESERT

This Bedouin woman's brow, lower lip and chin are daintily tattooed. Her elaborate jewelry includes a commonplace key, a safety pin and a piece of a comb.



©

Autochrome Lumière by Luigi Pellerano

A TOWN-BRED ARAB WOMAN: TRIPOLI

Such brocaded stuffs as would be out of place under the goat-hair tents of the nomads are worn by the Arab women of the town. Note, however, the tattooed cross on the forehead, which is also affected by the desert dweller (see Plate VII).

native troops has ended the menace of danger from the rebellious natives (see also text, pages 157 and 159).

TRIPOLI WAS A FAMOUS HAUNT OF PIRATES

The story of Tripoli goes back to the Phœnicians of Sidon, who founded it as a trading post, along with Sabrata and Lebda (called by the Romans Leptis Magna), the ruins of both of which are being excavated to-day (see page 161). It was formerly known as Oea, the name Tripoli being derived from "Three Cities" and first given to the whole territory, but gradually restricted to this one town.

Later a Carthaginian possession, Tripolitania passed, after the battle of Zama, in B. C. 202, to the Numidian Massinissa and his successors, and afterwards became a Roman province.

Near the harbor of Tripoli is an interesting Roman relic, an arch finished in the reign of Marcus Aurelius (p. 135).

In turn the Vandals, the Byzantines, the Arabs in the seventh century; then the original inhabitants, the Berbers, and again the Arabs in the eleventh century, possessed the province.

In 1146 the Normans captured Tripoli, held it for 12 years, but lost it to the Moslems. The Spaniards occupied it from 1510 to 1530, when Charles V gave it to the Knights of Saint John of Jerusalem, later known as the Knights of Malta, who were expelled in 1551 by Turkish corsairs.

The Turks gradually extended their dominion over all Tripolitania. In 1714 one of their officers, Caramanli, by wholesale murder and by bribing the Sultan, made himself practically an independent sovereign. His dynasty occupied the very shaky throne until 1835, when the Turks seized the country again.

Long before Caramanli's day Tripoli had become infamous as a haunt of pirates. Like many other European rulers during the next two centuries, Oliver Cromwell sent a fleet, under Admiral Robert Blake, in 1655, to destroy the corsair ships and release the Christian slaves. The Dutch, the French, the English, the Americans, and the Sardinians, all in turn attacked Tripoli on account of piracy, which, however, was not finally

ended until well into the nineteenth century.

In the war of 1911-1912 the Italians took Tripoli from the Turks and began the conquest of Libya, which, interrupted by the World War and the setback of the subsequent rebellion, is not yet completed in the eastern province, Cyrenaica, where they are still fighting hard against the Senussi. But the final issue is not in doubt.

In the western province, Tripolitania, the Italians have now established themselves firmly throughout the greater, or at least the most valuable, part. They hold solidly the line Ghadames, Sinaun, Nalut, Misda, Beni Ulid, Bir el-Hasciadia, Bir el-Gheddahia, Buerat el-Hsun, Tsémed Hassan, and Kasr Zafran (Sirte) (see map, page 138).

Inside their zone are peace, justice, order, freedom, and coming prosperity. Outside it lie the stony desert of the Hammada el-Homra and the sands and oases of the Fezzan depression, where lawlessness still exists.

ITALIAN OFFICERS MAKE DIFFICULT TRIP OVER TRACKLESS DESERT

The few rebels who hold out are so scattered and dispirited that, even on this desert zone, outside the line of military posts, one may say that the Pax Italica rests. The daring automobile expedition from Tripoli to Ghadames, a distance of 366 miles, and back, undertaken in March, 1925, by a party of 12 Italian officers and soldiers, a photographer, and a journalist, was not disturbed, although they had no military escort, carried only nine rifles, and passed through the No Man's Land outside the zone policed by the troops.

The object of the journey was to find a route over the trackless desert by which wheeled vehicles could maintain communication between Tripoli and Ghadames, the oasis nearly on the border line between Tripolitania and the French Sahara, and the most southerly spot held by Italian troops.

The party traveled in one Ford and five Fiat automobiles, with ordinary tires and without caterpillar bands.

At one point the expedition encountered great dunes, some of them 600 feet high, with the result that it took 30 hours



A BREAD MERCHANT AND BAKER OF TRIPOLI

One may buy his bread ready cooked or he may make the dough himself and take it to this shop to be baked (see text, page 137).



Photographs by Gordon Casserly

ISRAELITES IN AN ARABIC SETTING

The Jews of Tripoli are the business men of the city, and many of the trades are almost exclusively in their hands (see text, page 138).



Photograph by Gordon Casserly

TRIPOLITANIAN JEWS IN SABBATH ATTIRE

to go 500 yards, and only after nets had been put down could this formidable area be crossed.

CARAVANS ARE DESERTING GHADAMES

The oasis of Ghadames, which has an artesian well of warm water rich in medicinal mineral salts, was reputed to have 6,000 inhabitants a short time ago, but the caravans are deserting it and most of the trade now passes either via Agades and Lake Chad, in French territory, to the railway to Dakar, or toward Kano and the Nigerian Railway. The inhabitants, too, are gradually leaving it and only old men, women, and children remain. This deviation of the French Sudan commerce will mean a serious loss to Tripolitania.

The population of Tripolitania is estimated at about 550,000, a large proportion being nomad. Tripoli has 15,000 Italians, 2,000 Maltese, more than 8,000 Jews, and 32,000 Arabs, Negroes, and Kooloolies, or descendants of Turks and Arab women.

The coast line, from Cape Ras Ajir, on the Tunisian frontier, to Kasr el-Muktar, in the Gulf of Sidra, on the borders of Cyrenaica, is 660 miles in length. Except for the small gulf of Bu Kemes

(about 35 miles west of Suara), the low promontory on which Tripoli is built, and a few other very small features, it is unindented and devoid of natural harbors.

For the greater part of its length, especially in the west, the coast district, plentifully supplied with well water for irrigation purposes, has a chain of fertile oases of date palms, barley, fruit trees, and vegetables.

The Italians have built a railway from Tripoli for 74 miles along the coast to Suara, in the west; another to Tajura, 12 miles east of the capital, and a third line, due south for 31 miles, to Azizia. The last two are being continued, and the Tripolitanian Government is ready to extend the Suara Railway to the frontier of Tunisia, if the authorities of that protectorate will link with it the line from Gabes.

THE ITALIANS, LIKE THE ROMANS, BUILD FINE ROADS

Like their Roman ancestors, the Italians construct splendid roads, and, now that the rebellion has been stamped out, they are doing so in Tripolitania. One fine highway extends 75 miles east along the coast to and beyond Homs. Another



THE CHIEF OF TRIPOLI'S NEGRO COLONY

While all the races of the desert mingle freely in the streets and markets of Tripoli, the living quarters of each group constitute distinct communities, in the internal life of which native chiefs wield a definite and important influence.



Photographs by Gordon Casserly

TOO PROUD TO WALK

The workaday victoria is not usually associated with the Sahara Desert. Nevertheless, a number of the ebony ladies attending the festivals at the Negro mosque outside the city walls of Tripoli hire such vehicles to make the trip (see text, page 140).



HOLY BANNERS OF A NEGRO FESTIVAL

After the men have finished one of their ceremonial dances at the Negro mosque, the women form around the holy flags and two of their number pull the banners out of the sand and carry them off to the city (see text, page 140).



Photographs by Gordon Casserly

A NEGRO ORCHESTRA AT A RELIGIOUS FESTIVAL IN TRIPOLI

The dancing is usually accompanied by the thumping of large hand drums which suggest gigantic tambourines. To the rhythmic beat of these instruments the Negroes still perform the symbolic dances brought by their ancestors from the Sudan.



AN OASIS MARKET NEAR TRIPOLI

An interesting feature of the native markets is the butchers' section, where camel meat, beef, mutton, and goat are offered for sale. The butcher usually keeps his supply of meat "on the hoof," and the purchaser picks out his animal and has it killed and dressed before his eyes. When the butchers have dressed meat to display they often decorate it with gold paper or sprinkle it with black and white seeds to attract the attention of prospective customers.



Photograph by Gordon Casserly

A WANDERING MINSTREL OF LIBYA



Photograph from Frank Edward Johnson

BEACH BEAUTIES OF TRIPOLI



Photograph by Gordon Casserly

THE NEW DEFENSIVE WALL OF TRIPOLI

Despite the fact that Italian soldiers have pacified a considerable part of Tripolitania, raids by bands of desert warriors are not beyond the realm of possibility and a strong new wall protects the town oasis.



Photograph from Frank Edward Johnson

PALM TREES ON THE EDGE OF THE SAHARA

The date palm provides the native of Tripolitania with one of his most valuable commercial products as well as with one of his staple articles of food.



Photograph by York and Son

A CANE HUT NEAR TRIPOLI

The Negro village in the oasis near Tripoli consists of a collection of conical huts, each surrounded by a brush fence. It suggests a bit of equatorial Africa transplanted to the shores of the Mediterranean.

goes south for the same distance to Ghar-
yan and is being continued west to Yefren.

This latter route traverses the maritime plain and ascends into the Jebel, or mountain region. Outside the gates of Tripoli the country through which it passes consists of undulating dunes, generally covered with coarse vegetation, but in parts absolutely bare. To prevent the movement of the sand, the Agricultural Department is pinning it down with squares of stubble grass, inside which eucalyptus and other trees are being planted—a colossal undertaking.

The railway is approached and crossed several times, but the region looks unpeopled

and is devoid of houses, the inhabitants being nomads.

At Azizia, however, where until 1919 the Turks and the Arab rebels had their headquarters, there is a fort on a small hill, a government dispensary for natives, a railway station, and some one-storied buildings. There are no troops, but a few European civilians reside there.

Beyond, the plain, having become more level, is covered with grass and, in the spring, with an astonishing profusion and variety of wild flowers. Without moving a foot from the spot on which I stood one day, I picked 12 totally different species.



Photograph by Gordon Casserly

A TRIPOLITANIAN CAMEL MARKET

Until the Italians occupied Tripolitania, railroads were practically non-existent in this part of North Africa, communication being almost entirely by camel caravan. Most of the country can still be reached in this way only.



A WANDERING SAND HILL IN THE LIBYAN DESERT

The border between Tripolitania and Tunisia is very uncertain south of Ghadames. It has been the subject of consideration for various international commissions, but great moving sand hills, which completely change the contour of the desert from time to time, make it difficult to maintain a fixed boundary.

Vast fields of barley planted by the nomad inhabitants stretch to the horizon on both sides of the road.

Hitherto, at frequent intervals, mounted patrols of the Carabinieri, that splendid force of Italians and Arabs, have been met with. Now, every few hundred yards an Arab sentry stands by the wayside, although, in the pacified state of the country, there seems little need of this precaution.

Presently the long line of hills—bleak, stratified, and precipitous—runs across the country east and west, and up its steep face, by sharp zigzags, climbs the road made by the Alpini in 1913, a splendid example of military engineering.

From the summit the traveler is amazed to find himself in a new world, a land reminiscent of fertile Sicily. Green fields of barley, corn, and vegetables, groves of magnificent olive trees—some perhaps dating back to the Romans—fig, pear, and other fruit trees cover the undulating tableland.

Here and there rise higher hills, and, in one place, the crater of an extinct volcano.

The soil is evidently good, but it is cultivated in a haphazard way. The mystery is, Where are the inhabitants who till it? Scarcely a human being is visible, and no villages or houses are to be seen along the way.

THE PIT HOMES OF THE TROGLODYTES

This, the territory of Gharyan, which has a population of 30,000, is the country of the Troglodytes,* the dwellers under the earth.

They do not live in caves, but dig in the level ground pits from 20 to 30 feet



Photograph by Gordon Casserly

ITALIAN CIVIL AND MILITARY OFFICERS AT GHARYAN

Gharyan (Garian), in the Troglodyte country, is the center of a military and civil administrative district. Signs similar to the one in this picture, showing the distance to Mecca, are to be found all over the Moslem world (see text, page 160).

square and from 30 to 40 feet deep. To one side of each an inclined tunnel is burrowed down toward the bottom of the pit. Off the passage, at one or two levels, rooms are hollowed out, with openings for light and air, on to a face of the pit.

The ceilings and sides of the chambers and tunnels are damp with exuding moisture. A wooden door closes the entrance above, around which the excavated earth is spread in low mounds.

*See also "The Mole Men: An Account of the Troglodytes of Southern Tunisia," in the NATIONAL GEOGRAPHIC MAGAZINE for September, 1911.



Photograph by Gordon Casserly

IN THE PIT OF A CAVE-DWELLING

A Troglodyte village is entirely underground. Holes are dug from 30 to 40 feet deep and of various sizes. Numerous caves dug in the sides of the holes serve as living rooms, storehouses, and stables. These strange dwellings are entered by means of a passage tunneled through diagonally from the surface of the ground to the bottom of the pit (see text, page 159).

This strange type of dwelling is cheap and easy to keep in repair, is cool in summer and warm in winter (see above).

As one proceeds along the road, a few buildings are seen at last, but they are evidently European. They constitute Gharyan, until November, 1922, the headquarters of a rebel chief. Now it is the center of a military and civil administrative district under a general and a civil commissioner.

The post consists of a fort at the edge of a precipice, on the site of a Roman

castle; the beehive huts of a native infantry battalion; a few stone houses, the residences of the general, the commissioner, the officers, and the military club; a mosque, and the hospital, which once was the house of a rebel chief hanged for treason.

All around are the pits and yellow-clay heaps of the Troglodytes, but no above-ground village or habitations.

When at Gharyan I observed on a signpost upon which were tabulated in Italian and Arabic the names and distances of the neighboring stations, the inscription "To Mecca, 3,159 kilometers," a proof to the natives that the new masters of the land have no anti-Moslem prejudices (see page 159).

The district of Gharyan is from 1,800 to 2,100 feet above the sea, and its climate is good, resembling that of central Italy. Snow falls sometimes and there is generally an abundance of water for irrigation, from springs, wells, and cisterns. The inhabitants subsist largely on figs, of which they have 60,000 trees.

This district is a fair sample of the hilly region of Tripolitania and is suited to colonization.

EXCAVATION REVEALS WONDERS OF ANCIENT LEPTIS MAGNA

The coast road from Tripoli to Homs will soon be well known to tourists, for it leads to excavations that are now revealing the wonders of the buried city of Leptis Magna, at one time the most populous in Roman Africa. It runs parallel to the sea all the way, and for the first 12 miles passes through an astonishingly rich agricultural district, with many wells for irrigation, water from which is drawn up by bullocks, donkeys, and camels.

Two or three miles beyond Homs, a stretch of bare sand dunes lies between the road and the sea. One would not sus-



Wide World Photograph

A RARE FIND IN THE LONG BURIED ROMAN CITY OF LEPTIS MAGNA

This corner of a public bath, with mutilated statues of Apollo (left) and Aesculapius, the god of healing (right), has recently been rescued from Tripolitania's shifting sands (see text below).

pect that under these white mounds lies a city founded by the Phoenicians, which in the Christian Era gave a ruler to the Roman Empire.

But the spade is laying bare the ruins of Leptis Magna. Already the walls and arched gateway of the palace of its native son, the Emperor Septimius Severus, have been exposed after 1,200 years' burial. The admiring visitor may also see baths almost worthy of Rome, city gates and walls, a theater, precious marbles, a couple of streets, and part of a four-fronted triumphal arch.

From the dunes that have so long covered them are emerging the beautifully carved marble columns of the palace, erect and in position. Some are round, with artistic capitals; others are squared and chiseled with exquisite undercut designs of flowers, with the heads of animals inside, or with tiny groups of human figures wreathed with tendrils of vine branches. All are snow-white and nearly perfect.

Across the capitals of a line of pillars rests a long, rectangular marble block with the sharply cut words: "IMPERATOR CÆSAR AUGUSTUS LUCIUS SEPTIMIUS- —"

The thermæ, or baths, are even more surprising, for some of the walls stand 30 feet high. There are gigantic columns of colored marble and smaller white ones. Two marble-lined swimming baths, wonderfully preserved, still show the steps, the holes for the ingress and egress of water, and dressing rooms (see above).

All these wonders lay under 40 feet of sand. Down by the sea are the remains of the harbor mole, with the quay to which the galleys were made fast.

But the greatest treasure is a number of beautiful white marble statues and carvings as fresh as if made yesterday. A beautiful Venus is the gem of all.

Leptis Magna bids fair to rival Pompeii. But Tripolitania is daily revealing at Sabrata and elsewhere, other ruins of the trans-Mediterranean empire that the modern Romans are reviving.



Photograph by Dr. Henry W. Henshaw

THE BIRTHPLACE OF MOST CLOUDS

Evaporation, which furnishes the world's cloud materials, is a big drain on the seas; but water is fed back by rivers, glaciers, and showers to make good the loss. In all the world, it is estimated, more than 300 cubic miles of water fall as rain daily, or something like 16,000,000 tons each second. If Nature's laws were repealed and evaporation should cease, there would be a terrible demonstration of the priceless value of clouds. Every living thing of the land and air would be doomed, and all the earth except the sea would become a seared, desolate waste.

TOILERS OF THE SKY

Tenuous Clouds Perform the Mighty Task of Shaping the Earth and Sustaining Terrestrial Life

BY McFALL KERBEY

THE clouds of the sky may seem, like the lilies of the field, to toil not. But they do toil ceaselessly, and the record of their labors may be read in the mighty things they have done to and for the world.

Over and over again, in the millions of years they have been at work, they have carried all the oceans and have hurled them down upon the land—billions of cubic miles of water.

They have washed away mountains greater than the Himalayas.

They have filled up oceans as broad and deep as the Atlantic.

If we were to slice down through the crust of the earth for thousands of feet—a mile, five miles, in places, even ten—we would carve through cloud-built rocks, sediments laid down, grain upon grain, each carried by drops of water that have fallen from the skies.

The clouds have carved great valleys. The Grand Canyon is but one of their minor works, a labor of their yesterday.

They bore the feathery snowflakes which built up the huge glaciers that crushed and ground their way Equatorward during the Ice Ages.

They furnished the chief reagent for Nature's laboratory, dissolving and bringing together the minerals scattered through the rocks. The salt that savors our food, the clay that builds our houses, the iron that has made industrialism and the age of steel—to single out but three—are largely gifts of the clouds.

CHISELS OF THE SUN CARVE THE EARTH

Those are the labors of the past. But the clouds are working now as ceaselessly as they worked eons before man came upon the earth. Like the tools of the sculptor, these chisels of the sun, under the great mallet of gravity are steadily shaping the earth day by day.

They spend themselves to make the

streams, to water the crops, to feed the world. But new cloud generations are ever coming on to take their places.

They are mists; yet they form one of the staunchest pillars of life itself.

The birth of a cloud is a puzzle to the observer. The sky is apparently clear; then suddenly, seemingly from nowhere, a cloud patch is floating aloft. Nature seems to be playing tricks, like a conjurer who draws kicking rabbits from an empty hat.

MOST CLOUDS BEGIN IN OCEANS

Clouds may start from any water that can evaporate—a tiny dewdrop on a rose; the family washing hanging on the line; a bead of perspiration on your brow; spray from the garden hose; steam from the family teakettle or a speeding locomotive; puddles left by yesterday's rain; little brooks and great rivers; lakes of every size, and the broad oceans.

Most clouds have their beginnings in the oceans, started by the restlessness of the inconceivably small and inconceivably numerous water molecules that have fought their adventurous way to these great basins.

In the form of water, these little molecules are relatively at rest, huddled close to their fellows, but fairly free to slip about in the crowd of water particles. As they are pressed together, they vibrate, as do all other molecules of matter.

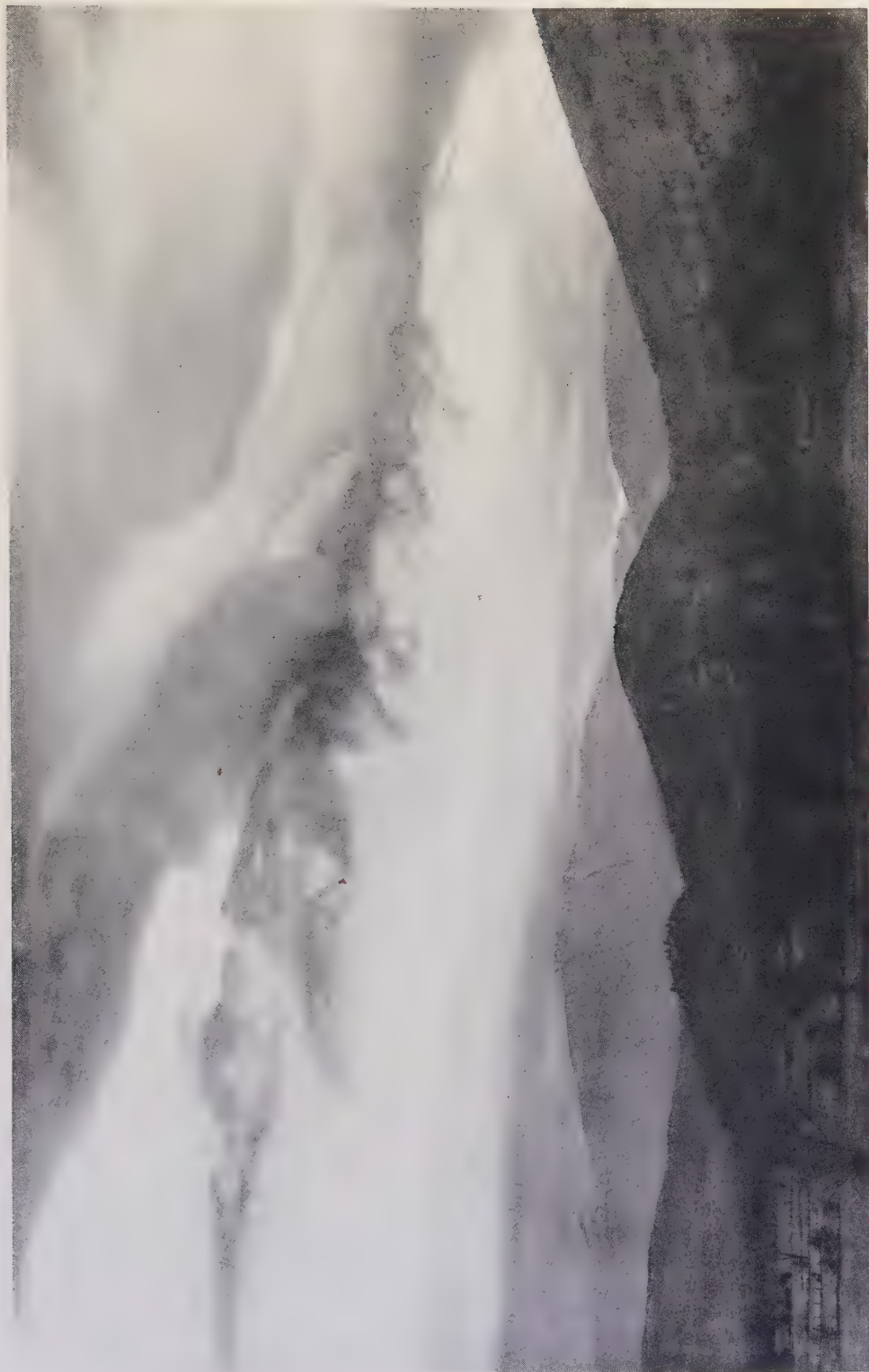
In the delightfully ordered world of the water molecules there is more room at the top than anywhere else, and there the most active molecules—made more active by greater heat—make their way. Some jump or are pushed above the surface, wholly outside the crowd—tiny distances in truth, but very far in comparison to their size. If one could watch these jumping molecules with the eye of a microscope more powerful than any ever built, they might appear like flying



© Herbert G. Ponting

SUCH STUFF AS CLOUDS ARE MADE OF

Countless billions of tiny molecules of water are constantly jumping out of the sea and into the air, through the process of evaporation, to form invisible water vapor. Normally the vapor that hangs over the sea is whisked away by the winds, still unseen, and is carried aloft by heat to build clouds. When the air near the sea becomes chilled, however, one of Nature's secrets is disclosed. The cloud stuff is seen floating off into the air just as steam rises, at a much higher temperature, from the boiling water in a teakettle.



Official Photograph, U. S. Army Air Service

AN ANTEDILUVIAN MONSTER FLIES ABROAD

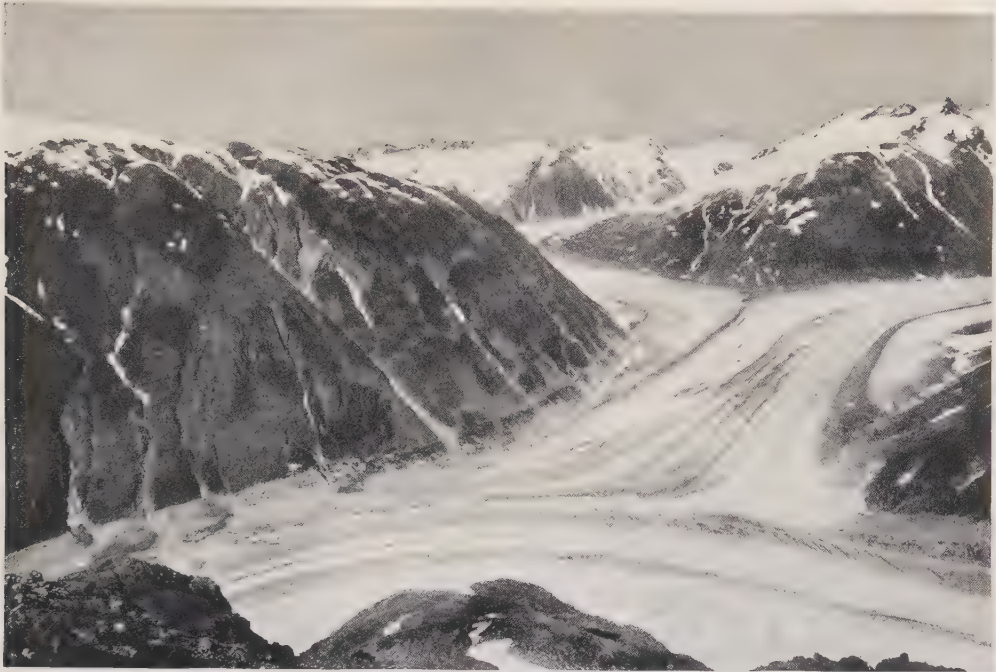
A little imagination can people the clouds with a vast horde of creatures never seen on land or sea, or crowd the sky with veritable castles in the air. Mountain ranges grow while you look; turreted walls tumble like those of Jericho; or a profile that puts a dozen "Great Stone Faces" to shame fills a whole quarter of the heavens.



Photograph by Jean Gaberell

NATURE IS NOT ABOVE COQUETRY

Just as a beautiful woman may enhance her charms by a veil that half conceals, half discloses, her loveliness, so Nature, casting a filmy scarf of cloud over her features, may lend to her peaks and crags a marvelous witchery. Fog shrouds the bases of these superb Swiss rock pinnacles and furnishes a feathery background for their lower profiles, while above float creamy masses of cloud that may be the seeds of later cumulus banks.



Photograph by O. M. Leland

AN ADAMANT CHILD OF GOSSAMER CLOUDS

Through their mighty progeny, the glaciers, clouds have dug huge furrows in the earth's hardest stones. They gouged out our Great Lakes, carved the beauties of Yosemite, and are ever plowing their way through countless mountain valleys. Like the ravens feeding Elijah, the feathery clouds bring to glaciers their daily ration of delicate snowflakes.

fishes darting from a tropical sea, or like toy balloons in a shop window set bounding up and down by air currents.

Like flying fishes, many of the molecules fall back into the water; but, unlike them, some can tear themselves entirely free. It is as if, magically, the fish became a bird. The escaped molecules are in a sense no longer water; they have become transformed by this process of evaporation into a vapor or gas.

Countless millions of billions of the molecules of nitrogen and oxygen, which for the most part make up the air, already occupy the space over the water, and the newcomers can advance into this crowd only by shouldering their way. So small and so numerous are the various molecules which make up the atmosphere that it has been estimated there are more than fifty billions of billions of them in a thimbleful.

The water vapor would eventually saturate the atmosphere if the latter remained entirely motionless, neither drifting aside

nor rising, or if further changes in temperature did not occur.

But, like a busy switching locomotive, the wind usually moves blocks of air from the water when they still are only partly saturated and shifts drier air blocks in.

HEAT HOISTS CLOUD MATERIAL

Temperature is really the master cloud-builder. It makes the water molecules leap from the water, and it provides the energy of the interfering air molecules. So, too, it makes the winds that transport the vapor and mix it with dry air.

Only futile fog can be built close to the earth. If vapor molecules are ever to form rain-giving clouds, they must be raised aloft to the cloud regions; and, again, it is heat which takes them there.

The region of the atmosphere in which water vapor can exist in appreciable quantities towers some seven miles upward in the United States, higher in the



Photograph by William Reid

BOTH WATER, YET DIVERSE AS DAY AND NIGHT

Lunge upward as it may, the water of the sea cannot join the water of the sky save by passing through a veritable Valley of the Shadow. Chemically the molecules of water remain H_2O through its changes of form, but it must die as a physical liquid before it can become a ghostly gas. While the sea of the earth is heavy and dense, the sea of the skies is unbelievably diffused. Condense a houseful of average cloud and it would hardly fill the pitcher on your breakfast table. A block of cloud as large as a huge hotel would scarcely furnish a bath for one guest (see text, page 176). The clouds shown here are cumulus and strato-cumulus.

Tropics, and lower near the poles. The atmosphere itself, in a rarer and rarer form, reaches upward for many scores of leagues. But beyond a certain point no considerable amount of moisture can go, because it is squeezed out by cold. Beyond the dead-line, no clouds can form. It is wholly within this seven-mile region that water vapor fights its battles and performs its manifold services.

Vapor molecules are lighter than the oxygen and nitrogen molecules of the air. The vapor-laden air therefore rises for

exactly the same reason that a balloon rises. The only differences are that Nature uses vapor (hydrogen and oxygen mixed) instead of pure hydrogen, works on a tremendous scale, and does not confine her light gas in a silken bag.

The warmer the air, the more vapor it can contain. If, on the other hand, warm air containing some vapor is cooled, its capacity for vapor diminishes. This decrease in vapor capacity takes place in a block of moist air as it rises into the cooler upper regions, and if it rises high



© International Newsreel Corporation

SUN AND SEA HAVE CLOUD-BUILDING RIVALS

Not all clouds are composed of vapor alone. Volcanoes send seething masses of ash and smoke and steam upward like towering black cumuli. Even lightning bolts flash from these somber mimic clouds. In arid regions winds may sweep thousands of tons of sand and dust far into the air, building Nature's only "dry cloud." A forest fire or the burning of a great city builds clouds, part smoke, part vapor. And now man, with his smoke screen, builds clouds to order to hide his military, naval, and aeronautical operations.



Photograph by American Colony, Jerusalem

A COLOR HYMN OF LIGHT AND WATER

One might imagine the splendid colors and the great shafts of light and shadow in the sky at dawn and dusk to be Nature's ritual of beauty, through which sea and sky and earth glorify their great benefactor, the sun; for it is the sun that creates vapor, lifts it upward, and spreads it out in feathery cloud masses. The spectacle of sunrise and sunset is a sort of chromatic "Te Deum" of the cloud droplets, tinted by all the colors of the spectrum, before they start earthward as the rain that keeps alive all the plants and animals of the earth. The clouds shown above are fracto-cumuli.

enough to cool to the critical point, it simply drops part of its vapor load.

This is the real birth of a cloud. The invisible molecules of vapor that jumped out of the water crowd of the sea into the air must leave their gaseous form in the twinkling of an eye. They must become water. But their sea is far below and, divided into inconceivably small particles, they cannot solve the problem by diving back into it. The only solution is to create, far up in the air, infinitesimally

small temporary "seas" of their own. Frantically they grab their nearest fellows and form tiny droplets that are hardly large enough to be seen.

As more and more droplets gather, they form a great misty mass thick and dense enough to obscure the sky.

MOST CLOUDS DO NOT RELEASE RAIN

There is a heavy mortality among the clouds, and rain is not always the immediate end of them. The pretty, fleecy



© Kolb Brothers

AN ELECTRICAL STORM AT NIGHT OVER THE GRAND CANYON

The vivid flashes of lightning and the thunder they create might lead the hypothetical man from Mars to believe that this demonstrative force of Nature dug the mighty chasm of the Colorado. But all the work was done by irresistible water. For long ages, clouds have discharged their burdens in the drainage basin of the river. Each cloud-born drop has taken its toll of silt grain or salt molecule and has gone its seaward way.

formations that lend an ever-varying beauty to the sky really make up the munition trains of the warrior clouds.

Nor is the water of the average cloud always passed on directly and simply to the rain clouds. It may pass through many forms, bound to a wheel of life in the skies for weeks before it finds at last the conditions that release it for its journey back toward the sea.

Temperature conditions may hold a cloud of extremely tiny droplets at the level where it was born, while winds blow it to drier regions or mix it with

drier air which will evaporate it. The sun itself may heat it from above and cause its molecules to leap out of the droplets as they jumped out of the sea. Often in summer one may see tiny wisps of clouds dissolving in these ways into air.

EACH DROP MUST HAVE A NUCLEUS

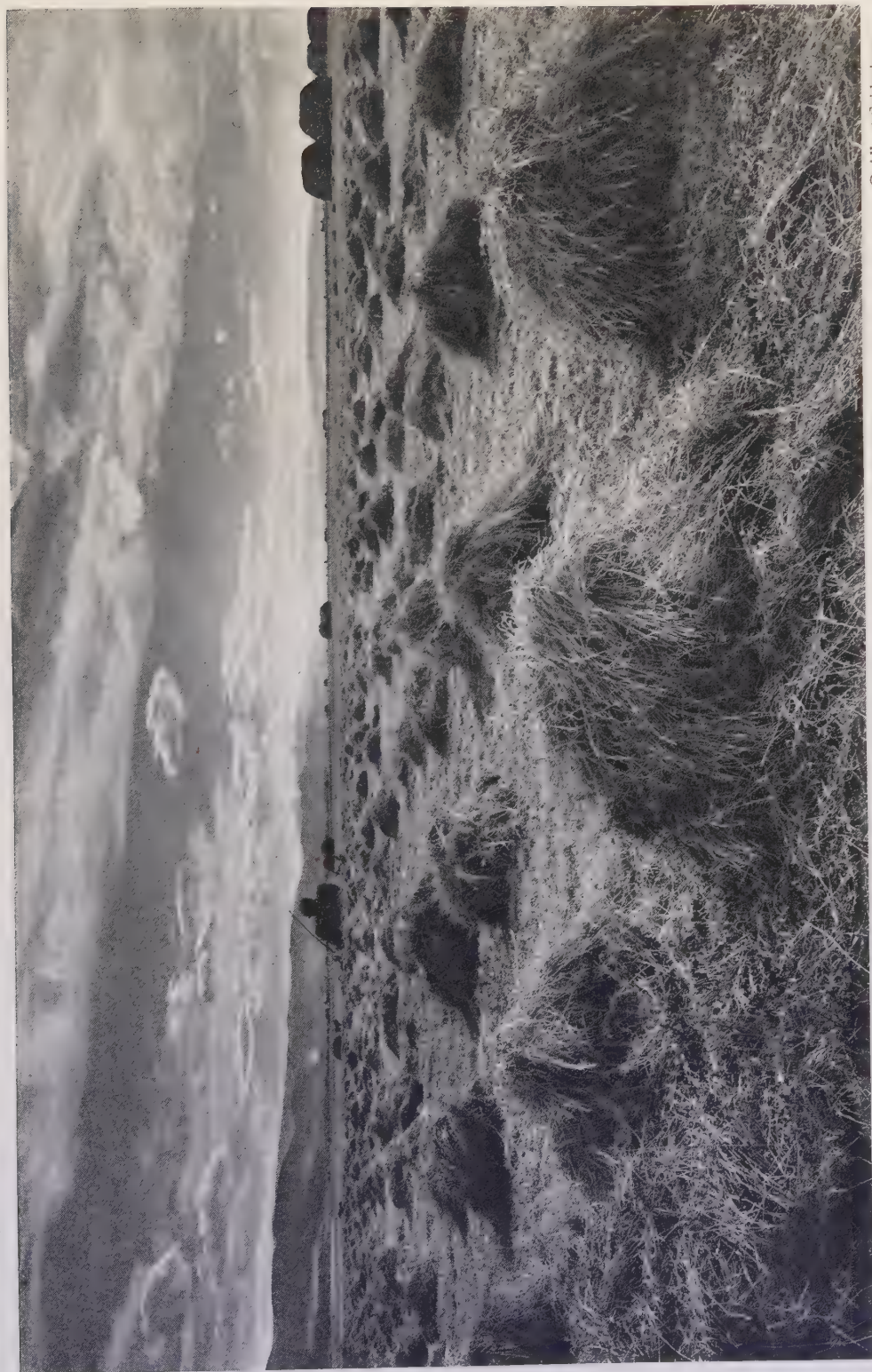
When water-vapor particles condense into water droplets, whether on their rise from the sea or after numerous cloud-making adventures, they not only grasp their nearest fellow molecules, but they must find infinitesimal bits of floating



Photograph by Sumner W. Matteson

AN ACCIDENTAL BIT OF "COMPOSITION"

Graceful gulls outlined against a splendid sunset and gilded waters, caught by the camera. A great artist, able to paint in what his taste and imagination dictates, could hardly better this grouping of animate and inanimate beauty. In the background the sun is lighting up alto-stratus clouds which are thick and opaque toward the center, thin and translucent near the edges.



© Albert Schleichert

THE FOOD OF 'TO-MORROW FLOATS IN THE SKIES OF 'TO-DAY

The Solomons overlooked this proverb, but the science of meteorology is ready to write it. The world has its life-sustaining circulation of moisture much as the body has its essential circulation of blood. The water that rises from the sea as vapor, condenses as clouds, and falls as rain makes the world's crops for man and beast before it starts again for the skies, on another cycle. The clouds are an ever-redeemed promise of our daily bread. The smaller clouds near the horizon are fracto-cumuli (broken cumuli); the formation near the upper edge of the photograph is cirro-stratus.



THE TORNADO CLOUD, TERROR OF THE SKIES

When a writhing black serpent of cloud forms, it means grave danger for those below. It is really a great suction tube that picks up trees and stones and man and most of his works as easily as a vacuum cleaner sucks up grains of dust and wisps of lint. Tornadoes have occurred in nearly every section of the United States. The one pictured passed close to the State Capitol of Texas, at Austin, a point farther south than the usual range of these destructive storms.

material, such as dust motes—a sort of magic carpet—and crowd upon them.

Dust usually is present abundantly, thanks to the winds and to volcanoes; and in the thickly peopled regions of the earth thousands of chimneys throw into the air in their smoke billions of potential cloud nuclei.

Even over the center of the greatest ocean there are as many as 750 dust particles in a thimbleful of air, and over the streets and buildings of large cities perhaps 200,000. In one cubic foot of air in any of our great cities there are twice as many dust motes as there are human inhabitants of the earth.

Widely separated, the dust motes, with their vapor passengers, at first float about like asteroids in space, but gradually the cold of the upper regions causes more and more of the vapor molecules to jump out of their gaseous form and attach themselves to existing droplets until the latter are built into drops heavy enough to fall earthward.

Sometimes the first drops of a thunder shower seem huge, as they flash past; but even the largest raindrops are relatively small. What is called popularly a "light rain," which just escapes being "drizzle," is made up of droplets only a trifle larger than the little black period that marks the end of this sentence. A "moderate rain" consists of drops with diameters only about twice that of the period, and the distance through a drop from a "heavy rain" is about that across four or five periods touching one another in a row. A rain classified as "excessive" has drops about the size of a capital "O" of THE GEOGRAPHIC's type. When drops larger than the latter fall steadily, the downpour is called a cloudburst.

And they can be only a little larger at that. Nature, through the laws of physics, has set strict limits both upon the size of raindrops and upon the speed at which they can fall; and the drop that attempts to pass either limit is promptly blown to pieces.



Photograph by Dr. Henry W. Henshaw

A PARADOX OF POWER

Strangely, man has never been able to harness the crashing waves of the sea; but the seemingly impotent clouds are reservoirs of energy that he taps continually. The scattered raindrops that clouds release, herded by gravity into rills and streams, turn man's water wheels as they scramble back toward the sea. Clouds, perhaps, are lighting your home, cleaning your floor, and boiling your morning coffee. The illustration shows a bank of cumulus clouds (see also cloud chart, page 187).

The largest raindrops that strike the earth have diameters about equal to the diameter of the average lead pencil.

The greatest speed at which a raindrop may strike the earth, no matter from how great a height it falls, is close to 30 feet a second—a speed less than that of a pebble dropped from a fourth-story window.

THE MOLECULES IN YOUR GLASS OF WATER

In the average cloud that floats on an overcast but rainless day—a cloud such

as those that bear most of the world's water from the sea—there are not more than two tablespoonfuls of water in cloud enough to fill the biggest furniture van; and, unless you live in a mansion, your dining room could not hold half the cloud substance that Nature has crammed into one glass of water on your breakfast table.

Try to count the invisible molecules that jumped out of the sea and traveled perhaps hundreds of miles that you may have your morning quaff. You will bankrupt arithmetic at the start, for it



Photograph by M. Rosenfeld

NATURE'S MASTERPIECE OF THE SKIES, THE SUNBURST

When great floods of sunbeams pour out through tattered clouds, marking long radial lines of shadow and light, tinting their paths with varied colors, an unsurpassed spectacle is created. The cloud mass shown is nimbus.

has been estimated that in a third of a thimbleful—a cubic centimeter—of water there are probably more than 32 trillions of billions of molecules, and in an ordinary glass of water there are 240 times as many!

A HOTELFUL OF CLOUD FOR EACH BATH

Consider your daily cloud consumption further. Your morning bath, in terms of the cloud that carried it, is probably more than 165 feet long and broad and deep. If you take it in a fifteen-story hotel cov-

ering a quarter of a city block, the building would barely hold enough cloud to give you a tub of water.

The water-supply system of a great city eats clouds by the skyful. New York City must have more than 730 million gallons of water a day and has provided hundreds of square miles of watershed to catch the necessary rain.

Picture the daily cloud quota for the city's water supply rolling up to discharge its burden, if all the water had to fall directly on Manhattan Island. The cloud



Photograph by Edgar A. Cohen

FOG PROVES THAT DISTANCE LENDS ENCHANTMENT

The earth-bound spirit of cloudland, fog, does not differ much from other cloud forms, save in position. Raise this clammy, depressing mass of vapor into the sky and let the sunbeams play about its edges, and it becomes a thing of beauty. Or climb above it and it appears an ocean of billowy foam. The photograph shows a sunset over the fog from Mt. Tamalpais, California. Note the corona about the sun.

bank would stand over the island more than 30 miles deep every morning and could hardly all turn to rain before the next 30-mile supply would come floating up to take its place.

MAN HARNESSSES THE CLOUDS

Clouds are power for man as well as for Nature. The clean white scrap of mist floating in the sky and the grimy, black lump of coal far under ground are brothers under their skins—both children of the sun. One, born millions of years ago and locked deep in the earth, must be toilfully dug out and brought to the surface before it will yield the power it holds. The other, born yesterday, will presently mine itself; and if its fragments are merely guided on their dash to the sea, they seem eager to turn man's machinery.

Man cannot tow his loads of sky coal where he will. Nature sends them along definite highways and dumps them with fair regularity in her chosen places. For ages man used them only near where they

fell or along the channels they wore in their slide seaward; but now he has in effect scattered the clouds. He has learned to transmute the down-hill wanderlust of their fragments into invisible but potent streams of electrons that will course along wires far from the old limiting channels. And now, though you live in a desert where you seldom see a cloud, you may have those of more favored lands for your servants. Press a button and they light your house, boil your coffee, and perhaps even curl your hair.

WHERE CLOUDS CONGREGATE

Fortunate it is that that portion of the sea which hangs ever in the air is scattered; for if all the clouds should gather and dump their burdens, now over one limited area, now over another, man and his works and most vegetation would be uprooted and swept from the face of the earth.

It is no less fortunate that rivers and



Photograph from Dr. S. Francis Howard

WHEN SKY BATTERIES BOMBARD THE EARTH—"HAILSTONES AS LARGE AS TENNIS BALLS" (TENNIS BALL AT UPPER RIGHT)

These huge hailstones fell at Pretoria, South Africa, Christmas evening (summer in the southern hemisphere), 1923. Raindrops are held within rigid limits. They cannot grow larger than the rubber eraser on the end of the average pencil, for air resistance blows them to pieces (see text, page 174). But hailstones can form as large as oranges—missiles that fall with the speed of cannon balls and which may wreck roofs, destroy crops, and kill man and beast. Hail is believed to be produced by upward gusts of air that carry raindrops into cold regions. The ice pellets may sink to the rain levels again and again, where they gather additional water, which in turn is frozen. Such a manner of growth is indicated by the onionlike structure consisting of concentric layers of ice. On the other hand, sleet, made up of tiny ice pellets, is formed by the freezing of little raindrops as they pass through cold air on their fall earthward. Conditions for the formation of sleet are usually present only in winter.

glaciers and clouds are pouring water into the seas almost exactly as fast as it is being taken out by the sun. If in some way the amount which now evaporates daily were pocketed in a Gargantuan cave or flung away into space, the oceans would last less than 2,700 years.

Though, mercifully, clouds are fairly well scattered over the earth, they have both favorite haunts and places which they shun, and they mark the regions where they gather as obviously as a cartographer colors his maps. The greens of fields and meadows, forests and jungles show in crescendo their favor, and the buffs of steppes and the browns of lifeless deserts mark the places they rarely visit or pass wholly by.

The favorite gathering place of clouds in all the world is the southern slope of the Himalayas, and the track of the monsoon which blows the loaded water-

carriers there from the Indian Ocean is their most congested roadway. The spot that seems above all others to attract them is the region about a little village in Assam—Cherrapunji, between the Bay of Bengal and the Himalaya foothills.

More than 38 feet (458 inches) of rain falls there in an average year, and in exceptional years more than 75 feet (905 inches) has fallen. This latter amount would be enough, if it fell in a city and accumulated without loss, to reach by the end of the year to the sixth or seventh floor of an ordinary office building.

Over a smaller area Cherrapunji's average annual rainfall is even exceeded in the Hawaiian Islands, where on the top of Mount Waialeale, Kauai, nearly 40 feet of rain falls each year.

On down into Burma, into the narrow peninsula of the Straits Settlements, and the East Indies, astride the Equator, ex-



© Herbert G. Ponting

A HOOD OR CAP CLOUD TOPPING FUJIYAMA

This is one of several special mountain clouds, the most striking of which is the true banner cloud. The latter forms in a stiff wind which blows moisture-laden air past the peak. As the moisture enters the windward margin of the cloud, it condenses and becomes visible; as it leaves the leeward edge, it again sinks into invisibility. The particles of cloud, therefore, are in rapid motion, but the form remains fixed.

tends the greatest cloud and rain belt of the world.

The next greatest gathering place and dumping ground of the clouds is in the western tropical portion of Brazil, where the Andes reach up and squeeze out the moisture into the tributaries of the world's greatest river, the Amazon.

Only in two other places do the clouds crowd together and give down their moisture in such measure as to be at all comparable to India and Brazil—on the southwestern coast of Africa's great bulge into the Atlantic and not far away under that continental eve where the coastline of Africa strikes southward again.

Well outside the Tropics the greatest

concentration of rainclouds in the world occurs in North America, along the southern "kite tail" of Alaska, though far to the south a narrow strip of southern Chile has almost comparable conditions.

On down into our northwestern States the cloud concentration extends in somewhat less degree.

POWER POSSIBILITIES SHOW CLOUD
GENEROSITY

Power possibilities clearly tell the story of the generosity of the clouds in this region. To visualize the extent of their contributions, one needs only to know that the State of Washington leads all other commonwealths in potential water power, and that nearly one-third the total

for the whole United States lies in Washington, Oregon, and Idaho.

Already much of this power is in use. Clouds, if you will, to-day pull long, heavy freight trains over the northern Rockies, light the streets of scores of cities, and pump the water that is rescuing from the grip of the desert wide stretches of land which the selfsame clouds decreed should be arid.

If fog be classed as cloud, there are regions of the earth where clouds blot out a sight of the sky for a large part of the year. A fog blanket closes down in the autumn on the tiny island of St. Kilda, west of northern Scotland, and is practically unbroken until early summer. On and near the Grand Banks of Newfoundland fogs occur often in spring and summer, blotting out sky and sea alike.

On the other side of the picture are the world's cloudless regions. The people of the desert coasts of Peru may go for years without the sight of a cloud.

Over parts of the Sahara and Gobi deserts and in the arid region that was German Southwest Africa clouds are scarce. In our own Southwest, near the mouth of the Colorado River, only five out of every hundred days are cloudy. So unusual is cloudiness in Yuma, Arizona, that one hotel there has made itself and its city famous by offering "Free board every day the sun doesn't shine."

NATURE TUCKS CLOUD BLANKETS ABOUT US

Clouds and cloud-stuff perform services not directly connected with the carrying of water and the creation of power.

Both in the form of water droplets, whose masses appear so dense, and as invisible vapor in a seemingly clear sky, they serve as screens by day to temper the sun, whose unrestricted rays, beating constantly on the earth, would parch and sear much that to-day is green and flourishing.

By night these same clouds and vapor particles are like an ample blanket tucked about the sleeping half of the world, keeping in the heat.

In grace of form, in light and shadow, in the contrast that deepens the blue of the sky, and in the varied hues captured from the sunbeams, clouds give to the world a beauty that could ill be spared.

They build real castles in the air: pleasure domes, pinnacled cathedrals that spring up while you look, as if Abt Vogler's demon builders and all the gods of wind and water were rushing them into shape.

On the horizon may grow, while you look, veritable mountains of cloud. Nearer may be a Sphinx, its features measured by miles, or a Colossus whose legs could bridge a wide bay as easily as their bronze patterns were reputed to span a narrow harbor's mouth.

While one watches, Icarus flies again, and, as of old, the wax of his fleecy wings melts in the sun's warm rays. A great ship sails into view, spray dashing, and in another quarter of the sky myriads of fleecy white sheep browse in an azure meadow.

SCIENCE EXTRACTS THE ROMANCE

Science puts it otherwise. The mountains and the Sphinx and the Colossus are cumulus banks, thunder heads, breeders of storms and lightning bolts (see pages 187 and 188). Icarus is but a fragment of cirrus cloud (see pages 181 and 182); the ship is a fracto-cumulus (see pages 170 and 173), and the browsing sheep are only some thousands of alto-cumuli (see pages 184 and 185).

There are three major types of clouds: cirrus, cumulus, and stratus; and all the numerous usual forms are combinations of these three (see cloud chart, pages 181 to 188).

Fogs form only because the wind has failed to play its part in cloud-building. If moist air continues to lie just above the earth or water, or drifts gently along without being pushed upward, it may cool to the condensing point. The upper reach of fogs is seldom more than 300 to 600 feet.

FLYING MAKES CLOUD LEVELS IMPORTANT

Clouds do not fly in a haphazard way in the sky. Certain types float in fairly definite zones, and are seldom found elsewhere; and between these cloud levels are cloudless zones, through which moisture usually passes in its invisible state to form clouds only when it reaches a "friendly" level.

These levels vary somewhat, and great storm clouds may ignore them and plunge



Photograph by F. Ellerman

TUFTED CIRRUS

These dainty and exquisite wisps of cloud are the most ethereal of the vapor creations of the sky. This and the following fifteen plates are from photographs selected by the United States Weather Bureau to represent the types of clouds indicated.



Photograph by A. J. Weed

CIRRUS: A FIBROUS FORM

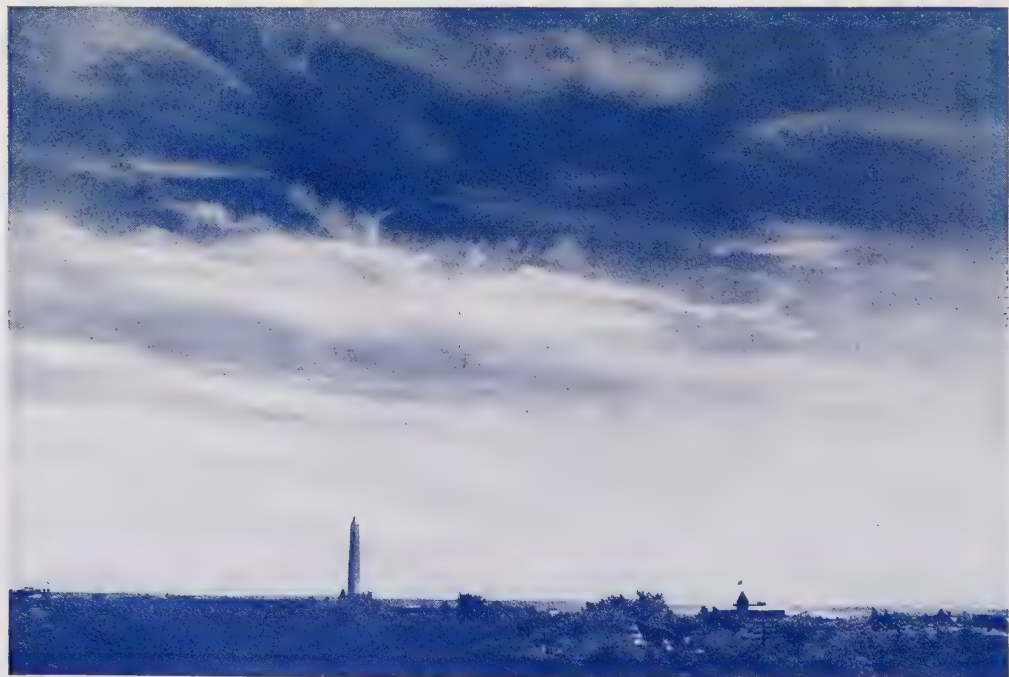
Whether it shows itself as faint wisps, long fibers, or dense bunches, cirrus has a characteristic delicacy, especially about the edges, which makes its identification relatively easy. This is because cirrus is almost always a frozen cloud, made up of tiny ice spicules and prisms—fairy needles so fine that only Titania, in a domestic mood, might wield them.



Photograph by Ebro Observatory

CIRRUS: A BUNCHED FORM

This type is somewhat denser than those shown in the two preceding plates (page 181). Cirrus clouds are described in the International Cloud Atlas as "detached clouds of delicate and fibrous appearance, often showing a featherlike structure, generally of a whitish color."



Photograph by A. J. Henry

CIRRO-STRATUS

The form shown in the lower part of this illustration is cirro-stratus. The upper portion shows bits of cirrus. The cirro-stratus sheet often produces halos—well-defined narrow circles of light surrounding the sun or moon and *at a distance from it*. They are to be distinguished from coronas, which appear to touch the source of light (see page 177).



Photograph by F. Ellerman

CIRRO-CUMULUS

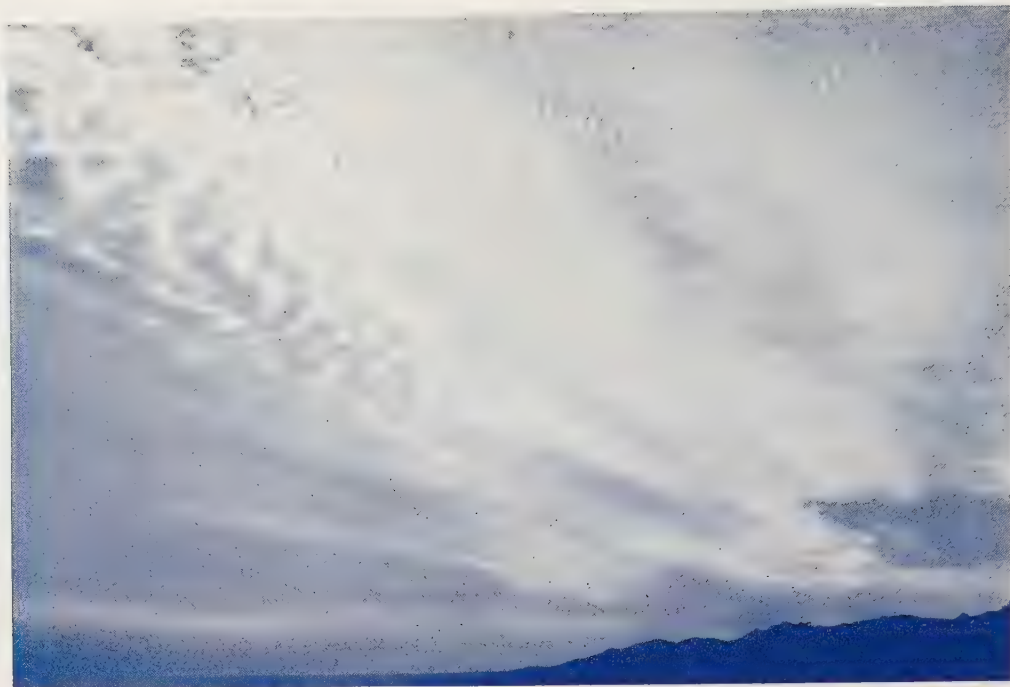
The official definition of this form is: "Small globular masses or white flakes without shadows, or showing very slight shadows, arranged in groups and often in lines." Cirro-cumuli are nearly always frozen, as are the other members of the cirrus family.



Photograph from U. S. Weather Bureau

CIRRO-CUMULUS: WAVED FORM

This, one of the lowest of the frozen clouds, floats from a mile to three miles higher than Pikes Peak. The beautiful waved structure is not a characteristic of cirro-cumulus alone; it is seen in practically all the thin clouds, from strato-cumulus up to cirrus. It is formed by air currents flowing past one another at different speeds, thus setting up waves.



Photograph by Ebro Observatory

ALTO-STRATUS (LOWER PART OF ILLUSTRATION)

This form consists of "a thick sheet of gray or bluish color, sometimes forming a compact mass of dark-gray color and fibrous structure. At other times the sheet is thin, resembling thick cirro-stratus (see page 182), and through it the sun or the moon may be seen dimly gleaming, as through ground glass."



Photograph by A. J. Weed

ALTO-CUMULUS: SOMEWHAT RAGGED

Alto-cumulus clouds are "largish globular masses, white or grayish, partly shaded, arranged in groups or lines, and often so closely packed that their edges appear confused. The detached masses are generally larger and more compact at the center of the group, but the thickness of the layer varies."



Photograph by A. J. Henry

ALTO-CUMULUS: UNDULATED TYPE

Alto-cumuli are the highest of the cumulus family. They usually gather some two miles up, in great crowds of small and medium-sized patches, partly shadowed, partly gleaming white, and produce some of the most striking of the cloud effects. It is they that form the prettiest "dappled skies." Shadows usually serve to distinguish small alto-cumuli from cirro-cumuli.



Photograph by W. S. Davis

STRATO-CUMULUS

"Large globular masses or rolls of dark cloud, often covering the whole sky, especially in winter. Generally strato-cumulus presents the appearance of a gray layer irregularly broken up into masses, of which the edge is often formed of smaller masses (see upper part of lower illustration, page 186), often of wavy appearance, resembling alto-cumulus."



Photograph by F. Ellerman

STRATO-CUMULUS

This photograph, taken from an airplane, shows a characteristic strato-cumulus effect in the lower portion, where the closely compacted fragments cover nearly the whole sky. Part of this effect is, no doubt, due to perspective. The form shown in the upper portion of the illustration is that of alto-cumulus (see lower illustration, page 184).



Photograph by Ebro Observatory

STRATO-CUMULUS

When strato-cumulus rolls such as those shown on the preceding page break up with a change of weather, the ragged form shown in the lower part of this illustration often results. Very striking sunset effects are brought about by an illuminated sky behind these broken strato-cumulus rolls. Such clouds usually fly from one-fourth to one and one-fourth miles above the earth.



Photograph by W. M. Lyon

CUMULUS

"Thick clouds of which the upper surface is dome-shaped and exhibits protuberances while the base is horizontal." Patches of cumulus such as these, seen after noon, usually indicate the continuation of fair weather at least for the remainder of the day and night. If observed in the forenoon they frequently grow into cumulo-nimbus (see page 188) later in the day.



Photograph by C. A. Gilchrist

CUMULUS ROLLS

Such clouds, when they mark the front of an arriving wedge of cool air, may develop thunderstorms locally. Cumuli with contrasting shadows and patches of gleaming white are easily photographed. Not so the sheet clouds, such as nimbus, which are especially difficult to record photographically. This latter is "a thick layer of dark clouds without shape and with ragged edges, from which steady rain or snow usually falls."



Photograph by A. J. Weed

CUMULO-NIMBUS, OR THUNDER CLOUD

"Heavy masses of cloud rising in the form of mountains, turrets, or anvils, generally surmounted by a sheet or screen of fibrous appearance (false cirrus), and having at its base a mass of cloud similar to nimbus. From the base local showers of rain (occasionally of hail or soft hail) usually fall." Cumulo-nimbus often reaches the very roof of the cloud world, seven miles or more up. It is from these clouds that lightning flashes.



Photograph by A. J. Weed

STRATUS

This is "a uniform layer of cloud resembling a fog, but not resting on the ground. When this sheet is broken up into irregular shreds in a wind, or by summits of mountains, it may be distinguished by the name of fracto-stratus." (Fracto-stratus forms are seen against the brilliant portion of the sky in the above illustration.)

through unbroken to a depth of seven miles; but in the sky, from day to day, the normal clouds ordinarily keep to their levels.

This cloud ladder of the sky, with its alternate spaces and rungs, has not been a matter of practical importance to man in the past; but now that he travels by airplane and dirigible the location of the clear spaces is of very great importance.

THE TERROR-INSPIRING TORNADO CLOUD

The only really terrifying cloud is that of the tornado. Dropping its great swirling black tail from a blanket of nimbus clouds (see page 174), it seems to be lashing the earth like some gigantic, infuriated dinosaur.

The tail is really cloud stuff and dust swirling around a suction tube that draws up everything in its path with an almost irresistible force—a Titanic vacuum cleaner. The rotary motion is given when streams of warm air rush from several sides to take the place of that which is rising. Once this swirling chimney of air forms it may persist for long periods.

It is at dawn and at sunset that Nature spreads her pigments among the clouds with a lavish hand. The happy coöperation of three of Nature's tiniest things makes a sunset sky a blaze of glory or a delicate pastel study whose perfection no painter can approach.

The infinitesimally short waves of sunlight would pour down merely as white light but for the diminutive dust motes that get in the way and sift out the component colors, from violet to red. And even when the colors are brought into existence they would stream on through the atmosphere and into space, if the all but invisible water droplets did not huddle together into clouds to capture them and hold them for the world to see.

The more dust, the more sumptuously the clouds are bathed in rose and gold and fiery red. The occasional storms that raise tons of dust into the sky of our own dry Southwest sometimes seem a trying cross for its people to bear. But there is a wonderful compensation. High in the air the tiniest dust grains atone for the sins of their coarser fellows. Nowhere else in the United States do the skies burst into such a glory of color at dawn and sunset, nor does the approach of twilight cast such magical, soft-hued shadows that

can transform bare, rugged mountains into fairylands.

Not all the most striking spectacles of sunset skies depend on color. In even the most gorgeously colored sky the shadows play an important rôle, and when the sun breaks through a tattered cloud, sending out great radial streams of light to plow through dusty and cloud-strewn air, it has created the masterpiece of sunsets, the sunburst.

THE RAINBOW, WHERE SCIENCES AND ARTS LIE HIDDEN

Of all the beautiful forms that clouds have brought to the world, the rainbow is undoubtedly that which has most stirred men's imaginations. For ages before geometry was known or the arch used in architecture, Nature flung across the sky this great geometric design, a pattern for future domes and portals.

The rainbow that one sees results from rays of light that are bent and in addition almost always reflected, by passing into and out of drops of water in the air. There are a number of possible rainbows having different positions, but the primary bow is seen much more often and more clearly than any other. This bow is always seen as the observer looks away from the sun.

A fascinating fact about the rainbow is that the bow to which you direct the attention of a friend is not the one he sees—your rainbow is yours and yours only.

And the falling raindrops are as colorless as the water in your drinking glass until they arrive at a certain line in the sky; then they flash forth their blaze of color for a fraction of a second and resume their colorless paths—colorless, that is, for your eye. But their pencils of colored light may be falling on another eye and creating a bow for it.

A rainbow, then, is not a material thing like a cloud or a tree. It is really a phantom of the skies, almost as evanescent as the apparent circle one draws in the air with a whirling torch.

The rainbow is a token, we are told, that man shall not perish by water. But every cloud that floats, though it be drab and unlovely, is a pledge that man shall have water to save him from perishing.

Clouds are, in truth, the ever-redeemed promises of our daily bread.



Photograph by A. Kerim

DESERT POLICE ON PARADE

The law officer (in the foreground) of the new Arab Kingdom of Iraq (Mesopotamia) is carrying his tribal banner. On their motor journey from London to Quetta, Major F. A. C. Forbes-Leith and his two companions passed through the desert region patrolled by these camel-mounted police (see text, page 220).

FROM ENGLAND TO INDIA BY AUTOMOBILE

An 8,527-mile Trip Through Ten Countries, from London to Quetta, Requires Five and a Half Months

BY MAJOR F. A. C. FORBES-LEITH

EARLY last year I decided to make an attempt to drive a motor-car from England to India, a journey which necessitated passing through ten countries and across two continents.

Airplanes had already flown to India on several occasions, airships for a regular mail service were in the course of construction, even one of the submarines of our Royal Navy was on its way, but as yet no effort had been made to bridge the distance by mechanical wheeled transport.

At least two-thirds of the journey would have to be made in Asia, through little-civilized country that could not be depended upon for car maintenance, so the method by which we should make the attempt was a matter for serious thought.

If we carried every spare part that might be required, and also a complete outfit of clothing necessary for the use of several men traveling through Europe and Asia, at least four cars would be needed. But in the event of the complete breakdown of one or more cars, the others would have to bear the burden of the extra personnel and equipment, thus creating many difficulties.

I decided to make the effort with a single car.

Then arose the difficulty of finding a suitable car, for it would have to be of stout build, and yet be light enough to man-handle often; powerful enough to climb almost any gradient with a heavy load, and yet of sufficiently low horsepower to be economical in petrol consumption. My choice eventually fell on a 14-horsepower Wolseley, fitted with an ordinary touring body which, with the exception of extra tankage, was in every way a standard pattern.

EXTRA EQUIPMENT FORWARDED IN ADVANCE

Personnel was the next difficulty. Finally I chose as diarist Mr. Allan Wroe,

of Leeds, and by arrangement with Pathé Frères, Mr. Montague Redknap was allotted to me to make a travel film.

Dumps of tires, spare parts, and film were sent ahead to Belgrade, Constantinople, Alexandretta, and Bagdad, but, in the car we carried nothing more than the ordinary motorist would take with him on a journey of 100 miles.

Personal baggage was limited to 35 pounds per man, and camera, film, emergency rations, spare parts, tools, two spare tubes and tires, and our three selves, weighed about 1,200 pounds. This, with a car weight of 2,500 pounds, made a total load of just under two tons.

We did not realize that our modest effort would interest the public but, a few days before we started, we were supported with enthusiasm by the press. The Lord Mayor of Leeds gave us a civic farewell, and, on passing through London, a large crowd assembled in Piccadilly Circus, that hub of London's gayer life.*

After a farewell lunch in London we left for Folkestone, and took the ferry across the 26 miles of sea that separate Great Britain from the continent.

CARTOON CAT THE EXPEDITION'S MASCOT

We adopted as our mascot, "Felix," the famous cat, and named the little car that was to be our home for five and a half months "Felix the Second."

What a lucky mascot he was, and what a laughter-maker he proved to be! Many times when we found a cordon of stern-faced customs officers awaiting us at a frontier, the sight of Felix, sitting grinning on our spare wheel, made them smile and softened their hearts toward us.

When we landed in France a tremendous change in conditions was immediately obvious. Humanity was working

* See also "London," in the NATIONAL GEOGRAPHIC MAGAZINE for September, 1915.



© Central Aerophoto Co., Ltd.

PICCADILLY CIRCUS, WHERE LONDON SAID GOOD-BY TO THE AUTOMOBILISTS

A large crowd assembled in this hub of the British metropolis to wish the author and his companions success on their motor-car journey across two continents.

under full pressure, and we were told that on that day there were only 16 registered unemployed men in the city of Paris. Hardly a square yard of soil could be seen that was not under cultivation. Men, women, and children, in quaint costumes and large wooden shoes, were planting, plowing, or gathering in every field.

Although we were passing through the war area on our southward run to Paris, not a trace of destruction could be seen. An atmosphere of prosperity and peace existed everywhere.

The British taxi driver has a bad reputation, but after driving through the streets of Paris among French taxicabs,

I came to the conclusion that he was worthy of a halo. The French driver of a cab drives like a juggernaut. Everything must give way to him, and his *laissez passer* is his siren; when that is blowing he stops for nothing.

Here we had the first of our two punctures, unfortunately picking up a horse-shoe plus the nails. However, a horse-shoe is supposed to bring good luck, and in this minor misfortune we certainly acquired an extraordinary degree of immunity from trouble later on.

In Paris we met the famous film actor, Mr. Douglas Fairbanks, who gave us a send-off and whispered to Felix to "Keep



Drawn by A. H. Bumstead

A MAP SHOWING THE AUTHOR'S AUTOMOBILE ROUTE FROM ENGLAND TO INDIA

on purring." Thenceforth we adopted as our slogan, "Felix keeps on purring."

The French are a delightful people, and it is a pity that both the British and Americans do not make a greater effort to understand them. Naturally, as a Latin race, their temperament is entirely different from ours.* Nevertheless, the effort to understand and fraternize comes more from the Frenchman than from ourselves.

STOPPING IN AN INN ONCE OCCUPIED BY NAPOLEON

Our first stop after leaving the gay city was at Briare, a delightful little village 70 miles to the south. Our hotel, a 14th-century structure, was most picturesque and the room in which I slept was occupied by the Emperor Napoleon in 1813 when he made the inn his military headquarters.

Although a great deal is written about the comforts of the old English inns, one must travel far to equal the joys of the French country *estaminet*. Can any other woman in the world hold a candle to the Frenchwoman for culinary inventiveness? During our run to the south we enjoyed

many a delightful four-course luncheon which had been prepared from no more material than would be served up daily in British hotels in the prosaic form of "joint, two vegetables, and cheese."

We lunched the second day out of Paris under the shadow of the 13th-century Castle of Flassons, whose war-battered walls are in a wonderful state of preservation.

After three days of travel through the beautiful valleys of the Loire and Rhône, and a short stay at the great industrial city of Lyon, we espied a tiny blotch of deep blue on the horizon, and soon afterward we arrived at St. Raphael, a pretty little seaport on the Mediterranean.

Along the coast we ran through Cannes, Nice, and Antibes, to Monte Carlo. The perpetual sunshine was in marked contrast to our own dull, foggy winter. The French always say that the British are a gloomy race who take their pleasures sadly, a fact that may be attributed to the lack of sunshine in our island home.

FROM TRIM FRANCE TO CARELESS, BUT COLORFUL ITALY

Beyond Mentone, most delightful of all Riviera resorts, we crossed the Franco-Italian frontier—from the neat trimness of France to the careless picturesqueness of Italy.

* See also "Our Friends the French: An Appraisal of the Traits and Temperament of Citizens of Our Sister Republic," by Carl Holliday, in the NATIONAL GEOGRAPHIC MAGAZINE for November, 1918.



Photograph by Major F. A. C. Forbes-Leith

A BEAUTIFUL, OLD INN AT BRIARE, NEAR PARIS

This picturesque village, 70 miles south of the French capital, was the first stop on the southward journey to Nice. The inn was used by Napoleon as military headquarters on one occasion in 1813.

A great change has come over Italy since 1919. In that year, when I passed through the kingdom from north to south, everything was in a state of chaos. Anarchy was rampant, the police and army corrupt, and for any officer to show himself in the streets in uniform was to court insult. Unemployment was a problem that threatened the very heart of the country.

But after six years one cannot fail to be impressed with the new Italy. The police force is efficient, the army operates normally, seemingly every factory is working, government sinecures have been reduced to a minimum, and there is work for every one. His admirers attribute this change, in the main, to Mussolini.

We soon reached Genoa, that great seaport which, next to Marseille, I regard as the most cosmopolitan city in the world.* As one sits for half an hour

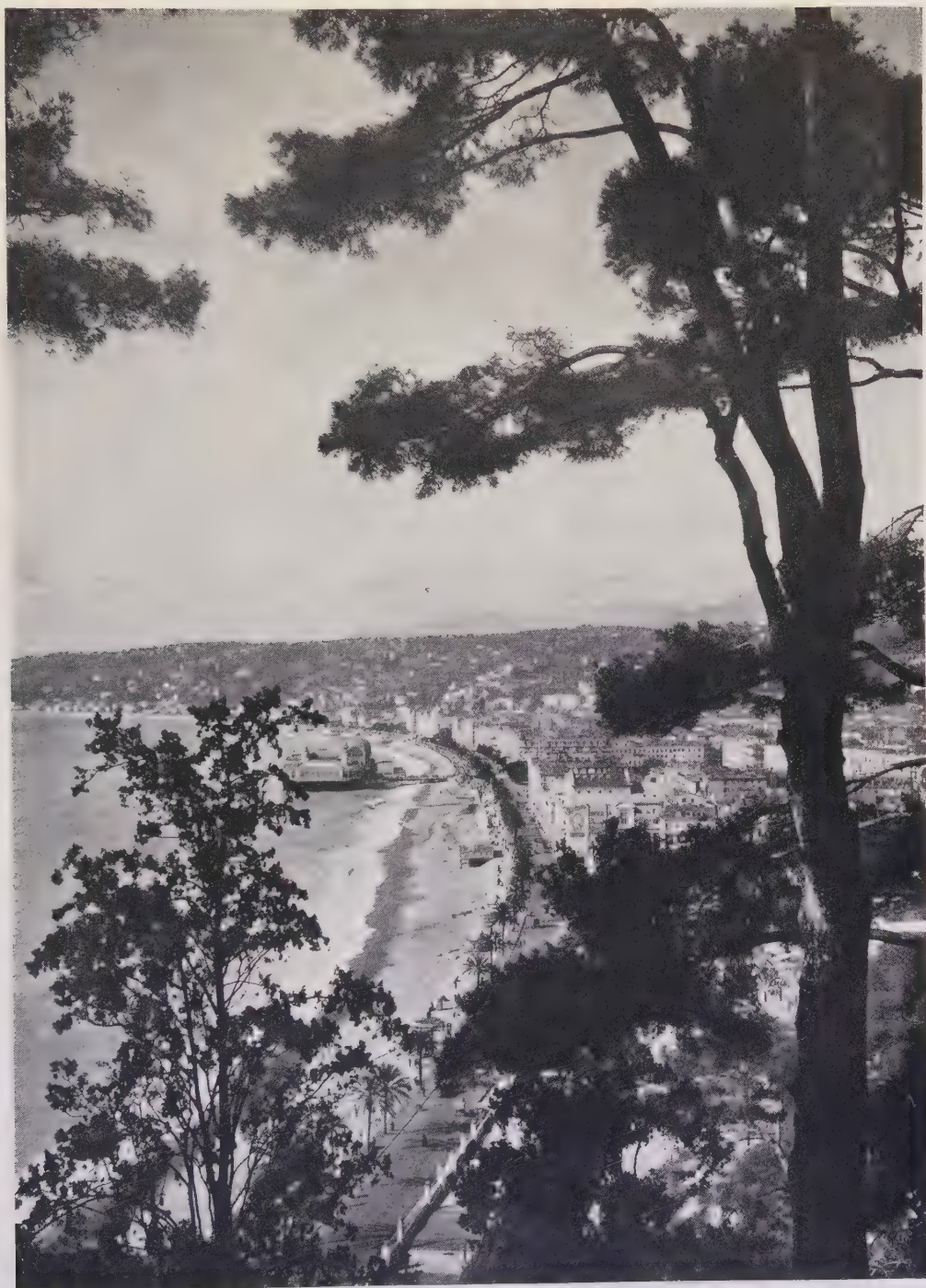
outside any of the great cafés, sipping an aperitif, he sees people of nearly every nationality. Arab and Hindu, Chinese and Turk, Moor and Russian, Malay and Japanese, in native costume, pass to and from the docks where, in that great rendezvous, the ships of all the nations of the world meet.

We traveled from Genoa across the fertile plains of Lombardy, on roads which, although perfect in surface, are thick in dust. The Italian chauffeur seems to have only one method of driving, and that is by "treading hard on the gas" from start to stop. Care of engine or tires is nothing to him, and road regulations mean little more.

In historic Padua, the hotel proprietor informed me that in his city the chauffeurs did not worry about rules of the road, and his logic in support of such a policy was very amusing. He argued that,

* See also "Frontier Cities of Italy," by Florence Craig Albrecht, in the NATIONAL GEOGRAPHIC MAGAZINE for June, 1915, and "Inex-

haustible Italy," by Arthur Stanley Riggs, in the NATIONAL GEOGRAPHIC MAGAZINE for October, 1916.



Photograph by Maynard Owen Williams

LOOKING DOWN ON THE QUAI DES ETATS UNIS, FORMERLY THE QUAI DU MIDI, FROM THE CHÂTEAU HILL: NICE

Beyond the pier known as the Jette Promenade the esplanade becomes the Promenade des Anglais. In the lower part of the picture can be seen the flat roofs of adjoining houses and shops which once formed the "Terraces," the parade of fashion before the Promenade des Anglais became famous.



Photograph by Maynard Owen Williams

A DAIRY SHOP, POULTRY STORE, AND GAME EMPORIUM BESIDE
THE OPEN-AIR MARKET IN THE COURS SALEYA: NICE

as there were no rules enforced, every one had to take such care in driving that there were very few accidents!

THE MOTOR BOAT VIES WITH THE GONDOLA
IN VENICE

The old architecture of northern Italy afforded us a continuing panorama of interest as we drove on to Venice.* Here, in a gondola with a picturesque gondolier, we wandered through the canals, past the haunts and homes of the doges.

One thing has tended to spoil the romance of Venice—the swarms of motor

* See also "Venice," by Karl Stieler, in the NATIONAL GEOGRAPHIC MAGAZINE for June, 1915.

boats and launches that infest the Grand Canal. The raucous note of their warning hooters is a poor contrast to the musical, warning call of the gondolier's voice as he comes to a bend or a corner.

What a unique personality is the gondolier! He is the cabman of Venice, a city which contains no vehicle larger than a wheelbarrow. And yet he is a man apart from his confrères in other lands. Consider the taxi drivers in any city, the jarvey in Ireland, the donkey and camel men of Cairo. Generally, they are the natural enemies of anyone who hires them. But not so the gondolier, for, from the minute you embark in his craft he is a friend who takes you under his wing.

If you do not understand Italian, he has a language of his own that enables him to tell you about everything that you

see, whether you are British, American, Latin, or Scandinavian. If you leave him for an hour, he does not worry, and you will find him singing happily to himself on your return. The gratuity which you offer at your destination is accepted with words of gratitude, and a romantic bow and flourish of the hat that are reminiscent of the chivalry of the Middle Ages.

On we moved, across the Italian-Austrian battle front, through miles and miles of concrete trenches, gun emplacements and redoubts, soon crossing the 1914 frontier. We stayed a while at Monfalcone, formerly a city of old Austria, where an extraordinary change of

conditions was observed. This town presents a sad sight, little changed since the Armistice. The ruins of hundreds of buildings remain as they were after the Italian shells destroyed them. On the débris have been built ragged huts of wood and iron. The depressed inhabitants stood at their doors and apathetically watched us pass. They seemed to have lost their all, including their interest in life.

COMMERCE DESERTS BEAUTIFUL TRIESTE

From here we had a long, steady climb through beautiful country and an hour before sunset breasted a hilltop and came suddenly upon one of the most glorious views I have ever seen—the city of Trieste, 1,500 feet below, beside a sea of blue glass.

Every building was of a different color; large liners at anchor looked like canoes. A white, gradually widening streak in the sea indicated the wash of a high-speed motor boat which was hardly visible to the naked eye. A large sailing ship, becalmed, seemed but a small speck of white.

This beautiful city has fallen upon hard times. Formerly the greatest port in the Austrian Empire,* commerce has declined since the city changed hands. There is little shipping in the harbor, and crowds of unemployed loaf about the sea front. Its one bright and busy spot is the factory recently acquired by Henry Ford for assembling his ubiquitous automobiles. This

* See also "The Land of Contrast: Austria-Hungary," in the NATIONAL GEOGRAPHIC MAGAZINE for December, 1912.



Photograph by G. R. Ballance

A STREET SHRINE IN MENTONE

is growing daily and giving employment to many.

THE FIUME "LIONS" OF ITALY'S POET-SOLDIER

Our next stop was at Fiume, the scene of the *coup* of Gabriele d'Annunzio, Italy's poet patriot. It is also a fine port, but a mean city in comparison with Trieste. A narrow river separates it from Susak, the Yugoslavian frontier town.

An impressive sight in the city was the great number of apparently idle young men with shock heads of hair fluffed out like a lion's mane. We thought this must be the latest thing in Fiume masculine styles until an English-speaking friend explained that this is the hall mark of



YOUNG STREET MUSICIANS OF GENOA

"Next to Marseille, I regard Genoa as the most cosmopolitan city in the world"
(see text, page 194).

d'Annunzio's "lions," who, with him, captured the city.

We were warned not to upset any of them, as they have the reputation of being excessively irascible and a law unto themselves.

After a night in Fiume, we crossed the frontier bridge to Yugoslavia. The incredible change made by those few yards is impossible to imagine—a jump from stagnation and slackness to hurry and bustle.

The only place into which the general energy had not penetrated was the customhouse. We had a letter of introduction to the chief revenue officer, who told us that, as a great favor, they would rush us through the formalities. The "rush" required six hours to deal with our small outfit!

The officials seemed to like our company. As soon as the papers were passed to a fresh clerk, he would come and have a friendly chat with us on European politics, our trip, and, in fact, anything but the business concerned. They were so cheery and genial that we could not take

offense; so we smoked endless cigarettes and waited.

EVERY VILLAGE CAFÉ IN YUGOSLAVIA HAS ITS ORCHESTRA

We were now in a new kingdom, a charming country of delightful, music-loving people. Every little village café has its orchestra of young men playing the guitar and mandolin, and accompanied by a trio or quartette of girl singers. The former stand and play; the latter sit in a row in front and sing national songs from dusk to midnight.

The Croats and Serbs are fine fellows of good physique, very hard workers, great patriots, and among the finest soldiers in the world.

Serbia, before the World War, was spoken of as a little Balkan state; now she must be reckoned as a power in Europe.

At Agram (Zagreb), the capital of Croatia, formerly part of the old Austrian Empire, we had a shock that made us rub our eyes. In front of us at the first crossroad, was the embodiment of an



Photograph by Donald McLeish

THE FAMOUS WINGED LION COLUMN OF VENICE

In the background rise the domes of the church of Santa Maria della Salute. "Here we wandered through the canals, past the haunts and homes of the doges" (see text, page 196).



Photograph Courtesy of Royal Italian Embassy

LOOKING DOWN UPON TRIESTE

This beautiful city, which before the World War was the chief seaport and naval base of the Austro-Hungarian Empire, has fallen upon hard times during the last ten years. There is little shipping in the harbor and the busiest spot in the city is the assembling plant for an American make of automobile (see text, page 197).

English policeman, with helmet, uniform, and baton complete. We heard afterward that the whole police force of the city was modeled and trained on British lines, even uniforms being supplied by outfitters in England.

In atmosphere, architecture, and general plan, Agram is a miniature Vienna. It has a fine opera house, and the architecture is for the most part typically Austrian.

Living is very cheap here for the man who carries either the pound sterling or the dollar.

BELGRADE EMERGES FROM WAR DEVASTATION

From Fiume onward, the war-worn roads had almost ceased to exist, and we had a weary struggle to Belgrade, capital of the Kingdom of the Serbs, Croats, and Slovenes.

A ruin at the time of the Armistice, Belgrade has made a wonderful recovery. In five years 4,000 new buildings have sprung up, and all the railway bridges and culverts which were destroyed have been rebuilt. Nearly every contract for reconstruction work has gone to Germany.

The Serbian government took a kindly interest in our plans, and wired ahead to every village on our route, ordering the various chiefs of police to do everything possible to assist us.

As we moved slowly south, the gradual change between West and East became more and more noticeable. In Nish the hat was being replaced by the tarboosh, carts by pack animals, and the water seller, with his laden goatskin, rattled his cups to attract attention.

All the Balkan nations live in a state of continual suspicion of each other and keep their frontiers in disrepair, deliberately making the railway the only easy means of passing from one country to another.*

IN THE LAND OF ATTAR OF ROSES

The road into Bulgaria had long been blocked by huge landslides, and in the Dragoman Pass we were obliged to take to, and run along, the river bed for miles.

See also "The Whirlpool of the Balkans," by Hon. George Higgins Moses, in the *NATIONAL GEOGRAPHIC MAGAZINE* for February, 1921.

On arrival at the frontier, we were informed by the chief customs officer that we were to be sent through the country duty free, as the government had taken an interest in our effort.

I have traveled in many countries, but have never met a people so delightfully hospitable as the Bulgars. Agriculturists with war-loving tendencies, they go out of their way to make smooth the path of the stranger within their gates. It was almost impossible to realize that we were passing through the territory of a former enemy.

One of the chief industries of the country is the cultivation of roses for making attar of roses. The industry is fascinating, and to be continually surrounded by thousands of acres of these beautiful flowers must tend to produce a happy peasantry.

As we passed through miles and miles of roses in bloom, it was delightful to see in the fields hundreds of women and children, in brightly colored short skirts and blouses, singing merrily as they labored.

AN AUDIENCE WITH KING BORIS OF BULGARIA

On our second day in Sofia we had word that the King, Boris III, would be pleased to receive us the following afternoon. At 4 o'clock, the appointed time, we rolled up in our well-worn tweeds and flannel trousers, that had been innocent of a pressing for many weeks.

Remembering Balkan tradition, I had visions of passing through lines of splendidly uniformed courtiers, to tremble in front of a magnificent throne, to kiss, perhaps, the hand of a monarch arrayed in purple and ermine, and to retire backwards, bowing with much ceremony. I could not see our travel-stained figures fitting into the picture.

An equerry told me that His Majesty would receive me alone, and that after the audience I was to introduce my friends and "Felix."

I was ushered into a large room, where a man of athletic figure rose from a desk, came forward, took me by the hand, and led me to a chair. In perfect English, and with the most engaging smile, he said, "Welcome, Sir, to my country. I am delighted to see you." I was at ease imme-



Photograph from *Unrest in Italy*

A VENDER OF WOODEN PAILS AND BARRELS HAVING AN AFTERNOON NAP AT FIUME

For a short time after the World War Fiume enjoyed a distinction similar to that of Danzig; it was a Free City, under the jurisdiction of the League of Nations, and was supposed to serve the joint interests of Italy and Yugoslavia. In January, 1924, however, the two countries agreed that Fiume should go to Italy and Baros to Yugoslavia. Fiume was the scene of D'Annunzio's spectacular exploit (see text, page 197).

diately and soon forgot that I was chatting with a reigning monarch.

In matters pertaining to motoring, the King is an expert. He always drives his own car, and, on his country estate, may often be seen plowing with an American-made tractor.

I told His Majesty that, owing to bad roads in Serbia, we had on a certain day run only 15 miles. He laughed, and claimed to have beaten my record once

on that same road during the war, when he was able to go only two miles in 12 hours, and added that on another occasion he drove for 22 hours continuously. "I went to sleep," he said; "the car left the road and overturned. Luckily I was not hurt, and, after an hour, some people turned it the right way up, and I went on!"

We were joined later by Princess Eudoxia, the King's charming sister, and



PREPARING WOOL, FOR CARPET WEAVERS: YUGOSLAVIA



Photographs by Major F. A. C. Forbes-Leith

YUGOSLAV WEAVERS DISPLAYING A RUG: PARADSHIN

Five women can make one of these small rugs in a fortnight. The work is done entirely by hand. Paradshin is midway between Belgrade and Nish.



© Hungarian Press Photographic Exchange

SOUTHERN SLAVS OF THE SAVE RIVER BASIN

The Slavs of this region are in easy circumstances. They are agriculturists and vine growers, and in addition they carry on home industries, such as weaving, embroidering, and linen manufacture. They are very fond of ornaments, especially necklaces made from Hungarian five-kronen silver pieces. As a race, they are a mixture of Turk and South Slav. Their cultural development was greatly injured during the supremacy of the Tatars and the Turks. The young woman is showing a girl's method of dressing the hair, but she wears a woman's cap.

went down to the grounds of the palace, where they examined every detail of our car. A pleasant hour passed too quickly.

Next day the president of the Bulgarian Automobile Association arrived as we were leaving our hotel. He led a procession of 30 cars, formed as an escort to give us a send-off. We stopped in the park, where short speeches were made, and were presented with bouquets. I was

relieved when the ceremony ended, without the painful necessity of going through the Gallic custom of exchanging kisses!

THE DIVIDE BETWEEN EAST AND WEST

A day's journey east brought us to country which, up to a few years ago, was part of the Turkish Empire. The trim, white-washed villages of Bulgaria were now replaced by the shabby, gabled buildings of the Turk. We came upon an object which convinced us that we had passed the great divide between East and West. It was a dead horse, surrounded by hungry, gorging dogs.

When a Mussulman's animals grow infirm, he turns the poor beasts out to die, or to be dragged down by scavenger dogs, because he has a prejudice against taking their lives. In the same way, beggars in the Orient carefully remove vermin from their bodies and place them gently on the ground for others to acquire!

Continual cloud-bursts and thunder-storms dogged us for many days. On the Bulgarian-Turkish frontier, many bridges were washed away, making progress almost impossible. On many occasions cartloads of timber had to be taken along for the construction of temporary bridges. On the actual frontier, Bulgarian and Turkish soldiers united their efforts to get us through the swamps.

In Turkey our troubles commenced and, officially, we found the Turk rather difficult to deal with. At Adrianople we were regarded with suspicion, particularly on account of my rank in the British Army.

The authorities thought we were spies and, to delay us, demanded over £300 duty on our car and its contents. I refused it and insisted on waiting until we reached Constantinople, where I could consult with our consul general. They declined, but promised to refer the question by telegraph to Angora, the capital.

In the meantime, although we were not actually prisoners, we were forbidden to leave the city. Ennis Behidj Bey, representative of the Turkish Foreign Office in Adrianople, was extremely polite, and when obstruction is handed out with excessive courtesy, it is hard to deal with.

ADRIANOPLE IS A FORLORN CITY

The unfortunate city of Adrianople has changed hands three times since the Balkan War of 1911-13. In those days it boasted 110,000 inhabitants, whereas now it has barely 55,000. Since 1923 all Greeks and Armenians, who handled most of Turkey's commerce, have been expelled from the country. Whole streets of houses and shops stand deserted; even shutters and window frames have been wrenched off by the Turks for firewood. The Armenian church was doing duty as a stable for the horses of a Turkish cavalry regiment.

After five days' delay, with no answer from Angora, I went to the Government House and bearded the Wali, or Governor. He was a stout, prosperous looking Turk, who politely apologized for inconveniencing us. I requested, with equal politeness, a permit to proceed to Constantinople, where I could settle matters with the help of the British consul. This, he said, to his great regret, was impossible.

I then told him it grieved me to think that, as special correspondent of important newspapers in various parts of the world, I could not write as well of Turkish hospitality as of the hospitality re-



A TURKISH BOY WITH BRAIDS IN MEMORY OF TWO SISTERS WHO HAVE DIED: YUGOSLAVIA

ceived in other countries. This mention of the press made him thoughtful; presently he changed his mind and told us we might go.

With immense relief we shook the dust of Adrianople from our feet, and moved on to Constantinople through mud and swamp, churning our way in impossible country. After four weary days we rested in the shadow of Sancta Sophia.

Constantinople of to-day is very different from the city of 1919, for the policy now is "Turkey for the Turk."

When we sought help from Aduan Bey, an enlightened member of the Kemal Government, he could not understand why anyone should wish to get to India by automobile. "There are no motor roads



Photograph by Ewing Galloway

A NEIGHBORHOOD CORN-SHELLING IN YUGOSLAVIA

Fourteen women and children have gathered to shell the crop of one farmer. In the background are two fodder stacks for cow feed during the winter months.

in Asia Minor," he said. "Why not put your car on the train? You can cross to the Syrian border in three days, without any trouble, and with much less expense."

When we insisted, I am sure he was convinced that we were spies, for all along our route the police and military were warned to watch us wherever we stopped.

It is of interest that some months later this same minister was responsible for a law which compels all male Turks in Asia Minor to put in free labor for seven days

a year on the building of motor roads. Apparently our little journey showed him the possibilities of mechanical transport.

THE ROYALIST-REFUGEE TRAGEDY OF CONSTANTINOPLE

The greatest tragedy of Constantinople is the royalist refugees from Russia, of whom thousands still remain.* Some brought enough wealth on which to live

* See also "Constantinople To-day," by Solita Solano, in the NATIONAL GEOGRAPHIC MAGAZINE for June, 1922.



Photograph from Ewing Galloway

A STREET SCENE IN BELGRADE, CAPITAL OF YUGOSLAVIA

Belgrade nowadays is a lively city of 110,000 inhabitants. For hundreds of years it was a buffer fortification between the East and the West, the scene of many battles between Turks and Christians, first in the hands of one, then in the hands of the other. In 1866 it was finally handed over to the Serbians. It has experienced a wonderful rejuvenation since the World War, 4,000 new buildings having sprung up in the last five years. Wide, clean streets, beautiful buildings, electric lights, electric trams, a national library and a royal palace commend it to the Western traveler.

decently; some started businesses and are making a comfortable living by hard work. The majority, however, seem to have lost all hope and to have sunk to the lowest depths.

As I stood at the door of that world-renowned hotel, the Pera Palace, a drunken man in rags passed, unwashed, with long, unkempt hair and beard, and

with shoes tied to his feet with pieces of string. He was once a famous general in the Tsarist Army. His case is not unique.

With the women it is worse. Many of title have put their shoulders to the wheel and taken jobs—when they could find them—as servants and waitresses; the greater number, however, have been less fortunate.



Photograph by Major F. A. C. Forbes-Leith

KING BORIS III EVINCES GREAT INTEREST IN "FELIX THE SECOND"

The Bulgarian monarch is seen inspecting the automobile in which the author had traveled from England to Sofia. In the background is Mr. Allan Wroe, a member of the expedition.



Photograph from L. G. Popoff

AN AIRPLANE VIEW OF THE CATHEDRAL OF SAINT ALEXANDER NEVSKI: SOFIA, BULGARIA

This, one of the finest examples of Byzantine architecture, was consecrated in the Bulgarian capital a few months ago.



© Ewing Galloway

THE 16TH CENTURY MOSQUE OF THE SULTAN SELIM II: ADRIANOPLE

Once a prosperous city of 110,000 inhabitants, Adrianople has suffered many reverses since the Balkan wars of 1911-13. To-day it is a forlorn outpost of Turkey-in-Europe, with an impoverished population of less than 60,000 (see text, page 205).

We crossed the Bosphorus and moved off on a road built by Alexander the Great about 330 B. C., and probably not repaired since. For 880 miles after leaving Skutari, our average speed worked out at two miles an hour! Many weary hours and days were spent in negotiating swamps, hills, mountains, landslides, and broken bridges.*

We moved along many places where no wheeled vehicle of any sort had passed for 20 years, but our car emerged triumphant.

THE ANATOLIAN PEASANT IS ONE OF NATURE'S GENTLEMEN

If the Turk officially is sometimes an obstructionist, as an individual he is one of the most charming of men. We were the recipients of many little acts of kindness and courtesy from both rich and poor in Asia Minor.

* See also "East of Constantinople: Glimpses of Village Life in Anatolia," by Melville Chater, in the NATIONAL GEOGRAPHIC MAGAZINE for May, 1923.

The peasant of Anatolia is one of Nature's gentlemen.* At a village where we stopped soon after leaving the Bosphorus, a strapping, fair-haired farm laborer left his work in the fields to run up and ask, "You Ingles, Sah?" We replied in the affirmative, and he shook hands warmly with us all. "Me prisoner of war with Ingles two year," he said. "Ingles very good to prisoner, give plenty food, good clothes, no make Turk prisoner work too much."

In nearly every village we were welcomed by one or more ex-prisoners of war, who would insist on supplying us with food for which they would not accept payment.

As we were now far from hotels, we existed on the food of the country. Eggs, curdled milk, dried curd cheese, thin cakes of unleavened bread made of roughly crushed barley, fruit of all kinds, and an

* See also "Crossing Asia Minor, the Country of the New Turkish Republic," by Major Robert Whitney Imbrie, in the NATIONAL GEOGRAPHIC MAGAZINE for October, 1924.



Photograph by Ernest B. Schoedsack

TYING RAGS TO THE WINDOW OF A SHRINE AND MAKING A WISH, PRACTICED BY THE WOMEN OF ANATOLIA

occasional chicken formed our staple diet. We went for days without seeing or eating meat.

At night we erected our camp beds beside the car, and, although in a dangerous country where brigandage was rife, we slept without guard, for after the strenuous work of the day we were too fatigued to do more than roll into our sleeping bags.

AMONG THE WHIRLING DERVISHES OF KONIA

Halfway across Asia Minor, we stopped at Konia, capital of the Turkish Empire up to the end of the Seljuk dynasty. It is a picturesque old city, and contains the

monastery and mosque which are the headquarters of the Mevlevi sect of dervishes. Although fanatical in many ways, they are among the least so of all Moslems in their attitude toward Christians. We called at the monastery and took coffee with the Father Superior.

These dervishes lead pure and saintly lives and practice the virtue of charity.

We were handed over to a bespectacled, benevolent, white-haired old dervish, who wore a loose robe of rough cloth, similar to that worn by monks in Europe, and a rough felt hat shaped like a sugar cone. He took us to the mosque, where, at the door, we removed our shoes, but retained our hats.

This building contained the tomb of Mevlana Jelal ed-din Rumi, who founded the sect in the 13th century, and the tombs of all the succeeding patriarchs.

In many instances the tombs are covered with gold plates, and on each one rests the turban of the departed, together with a lamp ready-filled with oil for use on the day of resurrection. The mosque itself is decorated with wonderfully colored tiles, and gold, silver, and precious stones.

We were shown the well-worn floor, where for centuries the dervishes have executed their fanatical dances. It was hard to imagine that the old gentlemen we met could endure the tremendous nervous and physical strain involved in spinning around like tops for 20 minutes without halting (see also page 212).

Forward we went on our weary way, sticking in rivers for hours at a time, held

up by the accumulated landslides of years, bridging torrents on a few planks, climbing almost impassable hills, and plowing through swamps until we reached the mighty Taurus Mountains.

After passing through the Cilician Gates, we rode over the plains to Tarsus, birthplace of Saint Paul, thence to Adana, on the plain of Issus, where Alexander the Great defeated Darius, King of Persia.

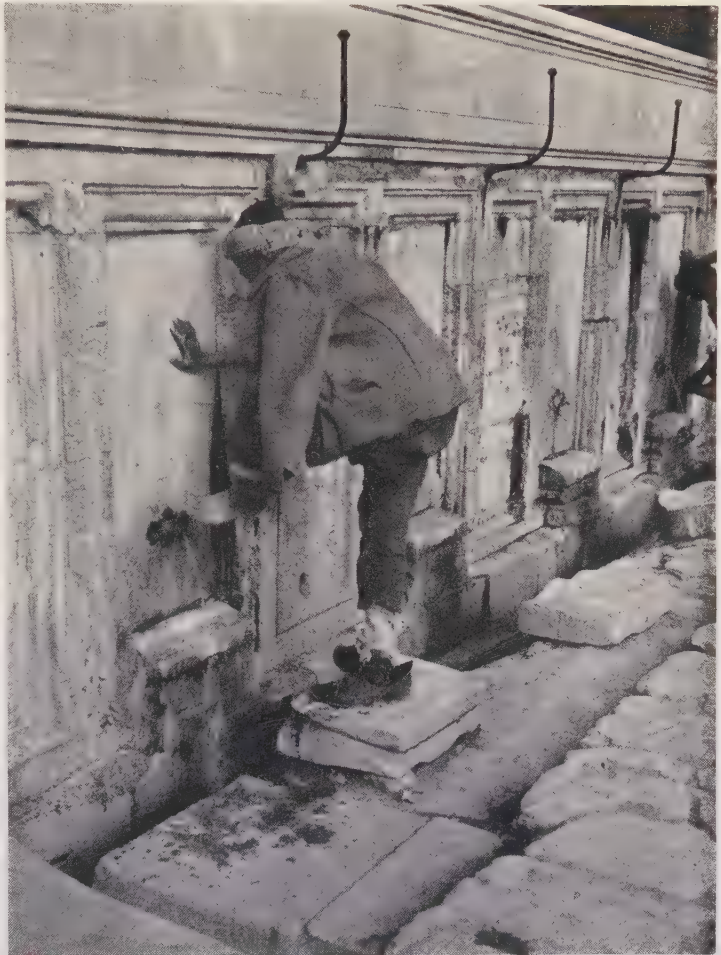
Finally we crawled slowly past the Turko-Syrian frontier to Alexandretta, in a land where the tarboosh was replaced by the flowing headdress of the Arab.

Breasting the famous Beilan Pass, regarded in olden days as one of the chief defenses of Christendom, and passing the Lake of Antioch, where the Apostles fished, we soon struck the caravan track to Aleppo, and struggled against a hot desert wind that dried our skin to parchment.

Long camel caravans, laden with carpets, spices, and rich merchandise of every kind from far-off places in Asia, continually passed us on their way to the coast. We saw the Persian from Meshed, the Turkoman from Bokhara, and the Arab from Bagdad.

We rode by a monument commemorating the last battle fought by General Allenby against the Turk in the Middle East,* and arrived shortly afterward at

*See also "An Old Jewel in a Proper Setting: An Eye-Witness's Account of the Reconquest of the Holy Land by Twentieth-century Crusaders," by Charles W. Whitehair, in the NATIONAL GEOGRAPHIC MAGAZINE for October, 1918.



Photograph by Merl La Voy

A MOHAMMEDAN WASHING HIS HANDS AND FEET BEFORE ENTERING A MOSQUE IN CONSTANTINOPLE

Aleppo, an ancient but unprepossessing city, and a great trade center.

The next day we skirted the Syrian Desert, where migrating Bedouin tribes frequently crossed our path. Since these people are robbers by nature and tradition, we were warned by French authorities in Aleppo not to make camp, under any circumstances, except within the confines of a town or village.

THE AMERICAN TRACTOR PENETRATES THE DESERT

Once, when we stopped for water, a crowd of Bedouins surrounded us and fingered everything loose on the car. Our mascot mystified them, and they grew very suspicious of him. Suddenly one



TURKISH WOMEN OF KONIA, ASIA MINOR



Photographs by Ernest B. Schoedsack

AN ASSEMBLY OF WHIRLING DERVISHES IN THE MOSQUE YARD AT KONIA

This is the headquarters of the Mevlevi sect of dervishes, who received the author and his companions hospitably (see text, page 210).



© Keystone View Company

A MARKET STREET OF DAMASCUS

Everything is sold here, from onions and potatoes to brilliantly colored cottons and rugs. Although much modernized in some quarters, Damascus has lost little of its oriental charm for the Western visitor; for, while electric trams now run in some of the streets, the picturesque camel caravans from Mecca and Bagdad come and go as of old (see text, page 214).



© E. M. Newman

INLAYING SILVER INTO BRASS AT THE SYRIAN ORPHANAGE AT DAMASCUS

For centuries Damascus has enjoyed a worldwide reputation for the skill of its metal workers, giving rise to the term Damascus, or damascene, steel. The city was also famous in the Middle Ages for its silk and linen fabrics; hence the word "damask."

called out that he was "Shaitan" or "Satan." I set off as hard as I could without arguing with them.

A little later we came across proof of the penetrating influence of civilization, even in the desert—a large American tractor and plow being demonstrated to a crowd of Bedouin sheiks. They were as enthusiastic as children with a new toy.

At Khan Sheikhun, a picturesque Arab town, we camped one night on the roof of the local police station. This necessitated our keeping a much more careful watch than if we had remained in the

open, for, of all the thieves in Syria, the native policeman is often the greatest.

Through the ancient cities of Hama and Homs we moved slowly, until, on the fifth day from Aleppo, we reached Damascus, the city of the seven rivers, and the ancient Paradise of the Moslem.

MODERN DAMASCUS HAS ANCIENT CHARM

Although modernized, Damascus has lost none of its charm. Electric trams run in the streets, but picturesque camel caravans from Mecca and Bagdad also come and go as of old. Damascus contains the tomb of that great warrior and enemy of the Crusaders, Saladin. Legend also gives Damascus as the place where Abel was murdered.

Here we had to prepare for a great test—the crossing of nearly 600 miles of desert to Bagdad. There is only one well en route, at Rutba, about half-way.

A transport company had already started a mail service on this route, with huge eight-cylinder cars. By condensing their radiator steam and averaging from 35 to 40 miles an hour, it is conducted with considerable success.

Crossing the desert with a small car, however, was a very different proposition, for, in addition to our usual load, an extra 200 pounds of petrol and water had to be carried. I engaged as guide a high-caste Bedouin, named Suleiman, who was reputed to know every mound and depression in the whole region.



Photograph by Ernest B. Schoedsack

A SILVER WORKER OF IRAQ

In Amara, near Bagdad, lives a religious sect whose members claim to be descendants of John the Baptist. All of them are silver workers, and many have shops in the Bagdad bazaar, where they advertise in English.

We started off one afternoon at 2 o'clock, and, after two hours' running in a hot following wind, were overtaken by a terrific sandstorm. I attempted to continue, but in a few minutes the sky was darkened with sand, and our eyes were too sore to allow us to move an inch. At that minute Wroe went down with a violent attack of fever, so I decided to make no effort to move until after sunset, when I assumed that the wind would drop.

THE DESERTCRAFT OF THE NOMAD

While waiting, Sulieman gave a demonstration of desertcraft, which illustrated the resourcefulness of the dweller in the waste. We were on a camel track, and he wandered about for a few minutes, collecting pieces of dry camel dung. After arranging these in a small hole scraped with his hands, he sat on the windward side, used his flint and steel, and had a fire blazing in a few seconds. Bringing a few small packages and a tiny copper pot from his pockets, he worked

for a few minutes and produced an excellent cup of coffee.

We rested that night, and pushed on next day over the never-changing desert, with its glorious mirages. After 21 running hours we sighted the palm-fringed Euphrates.

The only living souls passed en route were a small tribe of Bedouins encamped at the Rutba wells. They were a filthy crowd who, living in a land where water is more precious than diamonds, consider it a crime to use this valuable fluid for anything but drinking purposes. The sheik was a most unromantic figure, some of whose clothing appeared to have been worn since birth.

BAGDAD'S ARABIAN-NIGHTS' SPLENDOR
HAS DEPARTED

From the Euphrates, a run of two and one-half hours, brought us to the City of the Caliphs.*

* See also "A Visit to Three Arab Kingdoms," by Junius B. Wood, in the NATIONAL GEOGRAPHIC MAGAZINE for May, 1923.



Photograph by Thomas R. Owens

BAGDAD'S DRY DOCK: CONSTRUCTING A GUFAN

This bowl-shaped craft of the Tigris and Euphrates is a gigantic basket of woven reeds, usually plastered with pitch. When caught in a swift current, the passenger experiences a sort of merry-go-round voyage.



Photograph by Eric Keast Burke

TWO DESERT ARABS OF HIGH DEGREE SMOKING THE WATER PIPE (NARGHILE)
OUTSIDE A COFFEE SHOP

Notice the characteristic headdress—a dark-blue check handkerchief (*keffiyah*), folded diagonally, held in position by a double coil of wool or camel hair (*agal*)—and clothing, the tunic of fine material (*sibun*) and the cloak (*aba*). A Bagdadian, once asked whether he looked with favor upon the reforms of the new government, replied that all was a matter of indifference to him, provided his seat at the coffee shop was not interfered with or made uncomfortable!

Until Bagdad came into prominence during the World War, it existed in the minds of most people only as a mythical city, for in childhood they had read the fascinating *Arabian Nights'* Entertainments. In 1917, when the British forces entered the city, they were sadly disillusioned. I came to earth with a bump when a prominent Armenian citizen

greeted me and said, "Welcome, Sir, to the City of the Seven Great Smells!"

This described it accurately; in fact, he might well have added, "and to the dust heap of the world."

Although Bagdad contained a population of nearly 300,000 inhabitants at that time, hardly a single thoroughfare was wide enough for two of the crudest and



Photograph by W. Robert Moore

ONE OF TEHERAN'S ORNATE CITY GATES

In the background is a portion of the great Elburz chain of mountains, which extends without a break across northern Persia from the western shore of the Caspian Sea to north-eastern Khorasan. The loftiest peak of the range is Demavend, which rises to a height of more than 19,000 feet. (See, also, "An Ascent of Mount Demavend, the Persian Olympus," by F. L. Bird, in the NATIONAL GEOGRAPHIC MAGAZINE for April, 1921.)

smallest carriages to pass. It was possible to shake hands across most of the streets from the upper windows.

Organized sanitation was nonexistent; cholera and smallpox continually swept through the city and took heavy toll. The streets were crowded with thousands of half-starved pariah dogs which acted as scavengers, and hunted at night in packs, to the danger of anyone who moved about unarmed.

HOUSES AND MOSQUES DESTROYED TO MAKE A THOROUGHFARE

When General Townshend was threatening Bagdad, and the Turks found it impossible to move their heavy guns through the narrow streets, they cut a way ruthlessly through house, bazaar, and mosque, creating a thoroughfare which extended the full length of the city from north to south.

This highway was called New Street by the British when they entered. It was

then entirely devoid of metal. Ten minutes' rain made it a hopeless quagmire, absolutely impassable.

The Tigris, 300 yards wide, prior to the British occupation could be crossed only by a bridge of rickety old boats which sagged dangerously to anything heavier than a bicycle.

Added to all these discomforts was the climate. The summers are terrible, and during the months of July and August, the thermometer records temperatures of from 120° to 130° in the shade. Little wonder that Bagdad was formerly avoided by most Europeans.

THE BRITISH BRING CIVILIZATION'S CONVENIENCES TO BAGDAD

With the advent of the British a miraculous change has been wrought. Bagdad to-day is almost unrecognizable by those who knew it ten years ago. New Street is well metaled, and footwalks built of solid brick skirt the road. Two fine

bridges across the Tigris open and shut quickly by mechanical power to permit river traffic to pass, and both are approached by wide, metaled roads.

Hundreds of motor cars pass down New Street, and this traffic is controlled at every crossroad by an efficient police force. There is now a taxicab service of luxurious cars that cannot be equaled anywhere else in this part of the world.

Two miles outside the city, on what was barren desert a few years ago, has sprung up a new town where all the Europeans reside. Officials with their families live in comfort the year round in well-built bungalows, the last word in scientific, heat-resisting architecture, and fitted throughout with electric fans. An electric power station lights the buildings and streets, and ice factories produce at low cost an unlimited supply of this most necessary commodity.

Wherever the Briton has penetrated, he has taken his sport with him. The Alwiyeh Club, recently built on the banks of the Tigris, offers polo, tennis, and golf. A bathing parade I saw there one evening in August would have rivaled Trouville. There is also a fine race course with stands for all classes, where, in season, two excellent meetings a week are held.

BAGDAD IS STILL THE REAL EAST

A railway connects Bagdad with Basra and a motor mail service which bridges the Syrian Desert from Damascus (see



Photograph by Basil Avezathe

A PERSIAN BARBER IN GOOD HUMOR

As customers are only shaved about once a week, the clippers are first necessary. The hair of the head is also shaved from the forehead to the back.

text, page 214) has brought it within nine days' journey of London.

Nevertheless, Bagdad is still the real East. At the bazaar gates, where Indian, Arab, Persian, Kurd, and Turk rub shoulders, civilization has halted. The water seller carries his goatskin and sells to the thirsty; the money changer sits in a hole in the wall and rattles the British sovereign and Turkish lira to attract custom; the barber squats and shaves his client by the roadside.

In town, the rich merchant stops his luxurious motor car to allow a camel caravan from the borders of China to



Photograph by Major F. A. C. Forbes-Leith

"FELIX" BEING TOWED THROUGH THE SILVER SAND HILLS OF DASHT-I-LUT, THE GREAT CENTRAL DESERT OF PERSIA

These Persian peasants walked over 40 miles of waterless desert from their village and 40 miles back to tow the car through this impossible sand, which is seemingly without bottom. Their pay for this walk and their whole day's work amounted to one dollar per head, and they were happy!

pass into the desert where, five miles outside the city, the Arab still tills the ground with primitive implements such as were used in the time of Christ.

From Bagdad we visited the ruins of Babylon,* a city which in the time of Nebuchadnezzar was reputed to cover a greater area than New York and London combined. Excavations have disclosed the palace of that great king, the famous Ishtar Gate, the Hanging Gardens, and many other ruins of absorbing interest.

We also visited Ctesiphon, where the famous vaulted hall of the winter palace of the Parthian kings still stands in a wonderful state of preservation. It is built of brick, was erected without a molding, and, standing 115 feet high, is regarded as the most splendid example of Sassanian architecture.

* See also "The Cradle of Civilization," by James Baikie, and "Pushing Back History's Horizon," by Albert T. Clay, in the NATIONAL GEOGRAPHIC MAGAZINE for February, 1916.

After a prolonged stay in Bagdad we moved on over 100 miles of desert to the foothills of Persia. A day later we climbed the famous Pai Tak Pass, and, on the great Persian plateaus, more than 6,000 feet above sea level, found relief from the scorching sun of the plains of Iraq (Mesopotamia).

PERSIA RESEMBLES SWITZERLAND

Persia is generally believed to be a barren desert. On the contrary, it is a glorious but vaster Switzerland. On every side except the east, it is surrounded by hills leading up in gigantic steps to a vast plateau extending to the west, north, and south, and dropping suddenly in central Persia to a great desert, the Dasht-i-Lut, whose saline swamps and dry salt area are more particularly known as the Dasht-i-Kavir.

The Persians are of pure Aryan stock, fairly similar to Europeans in appearance, but in temperament a race apart.



Photograph by Major F. A. C. Forbes-Leith

DAWN ON THE PERSIAN DESERT

The previous night the author and his companion, Mr. Redknap, stuck in deep sand, were 17 miles from the nearest water, which was almost salt. The Baluchistan Camel Corps Patrol passed and kept guard over them for the night. This spot is near the border of Baluchistan and at the extreme westerly edge of the Dasht-i-Lut (see text, page 222).

In 1920 I was managing the lands and courts of a feudal noble of Persia. During the trial of an intricate case one afternoon, the peace of the courthouse was disturbed by the wife of Yadullah, one of my laborers, who rushed in crying and showed two badly bitten fingers.

During her absence from her house a negress had come and helped herself to some firewood. As the intruder was leaving with the spoils, the wife of my servant returned and a fight ensued, during which the biting occurred.

MOSLEM DIVORCE IS SIMPLE

I was annoyed at being disturbed and told my personal servant, Hussein, to see Yadullah and tell him that he could deal with the negress himself. A few days later I asked Hussein if Yadullah had punished the negress.

"No, Sahib," he said. "He married her this morning!"

"Good gracious," I replied, "Whatever for?"

"Oh, you don't understand, Sahib," said Hussein. "If he not her husband, and he give her good hiding, he get into plenty trouble. So he marry her this morning, to-day he take all her things, and to-night he give her good hiding, turn her out, and divorce her."

As is generally known, divorce in Moslem countries simply consists in telling a wife, in the presence of two witnesses, to depart.

During Great Britain's occupation of Persia, which was a neutral country in the World War, a British soldier was killed by brigands near the lands which I controlled. As the British general in command of the district disliked to interfere with the internal economy of the country, he suggested that I take out some of my Persian soldiers to clean up the band.

Before I started, my employer suggested, "Ah, Major, you nevaire take zis man wiz ze fight, much better take him wiz 'ze politic.'"

I asked what he meant. "Well," he said, "you write him one letter and say, 'I very sorry all mans are against you, but I am your friend always. You come my house, you be my guest, I hide you, and not let police take you.' And zen, when he come, you take him queek!"

On we moved, through Kirmanshah, pausing a while at the tomb of Chosroes; thence through Hamadan, known in ancient history as Ecbatana, where we visited the alleged tomb of the prophetess Esther and the famous seven-walled citadel.* And so on to Teheran, the capital.

At Kirmanshah we met the sad procession carrying the body of Major Robert Whitney Imbrie, the late American consul who had been murdered by a fanatical mob at Teheran. The cortège was accompanied by many Persian officers of high rank who acted as an escort as far as the coast.

PHOTOGRAPHING IN PERSIA UNDER AN ARMED GUARD

In the capital we found that the word "camera" made every high official nervous, owing to the recent Imbrie tragedy, but eventually we were allowed to photograph under a strong escort. For the next few days our car was a veritable arsenal, conveying our guard of a Persian officer and two soldiers, all armed to the teeth.

We visited the palace and were privileged to see the famous Peacock Throne, taken by the Persians at the sack of Delhi. It is studded with precious stones and is reputed to be worth \$30,000,000.

A feudal system still exists in Persia. Most of the land is owned by wealthy nobles, who pay a tax to the government. The system of taxation is now superintended by American advisers, who have been able to eliminate evasion and corruption to a large degree, although much malpractice still continues.

Corruption and bribery are rife, and, knowing the state of affairs so well, I pay homage to the American gentlemen

* See also "Persian Caravan Sketches: The Land of the Lion and the Sun as Seen on a Summer Caravan Trip," by Harold Weston, and "Modern Persia and Its Capital," by F. L. Bird, in the NATIONAL GEOGRAPHIC MAGAZINE for April, 1921.

who are fighting such an uphill battle in stamping out these vices.

THE PERSIAN FARMER IS HARD-WORKING, BUT CHEERY

Each noble is supreme governor over all who farm his lands. His tenants pay tribute in the form of money, chickens, sheep, grain, and other produce. The farmers, generally, are downtrodden. If they complain and incur the wrath of their master, he can throw them into jail, beat them, or treat them according to his pleasure.

As an individual, the Persian farmer is a clean-living, hard worker of fine physique. His hours of labor are from sunrise to sunset, and in his village, in spite of oppression, he leads a cheery, happy life.

Opium-smoking is the curse of the urban Persian, but as yet the farmers have not taken it up. Doubtless the healthy life the latter lead enables them to withstand any craving for artificially produced sleep.

At Teheran we had to leave Wroe behind with typhoid fever.

We moved off on the last stage of our journey through the salt desert of Kum and rested a while at Ispahan. This beautiful city was the Persian capital until the Afghan invasion in the early eighteenth century.

We now crossed a part of the country where many tribes were moving, and were chased for some miles by horsemen. Luckily we were on a plain and our superior speed enabled us to escape.

We stopped at the ruins of the city of Persepolis, that great relic of an early Persian civilization, which was burnt by Alexander the Great at the instigation, so legend says, of Thaïs the courtesan. On again to Shiraz, a city studded with magnificent trees, whose beauty makes it easy to understand that Sadi and Hafiz, the famous Persian poets, received their inspiration here.

NIGHTMARE PROGRESS THROUGH SAND

The next 750 miles to the Indian border were one long struggle with salt and sand in a country which in many places could not produce an egg or a blade of grass.

On the borders of Afghanistan, when we crossed the Indian frontier, our daily progress in the sand was a nightmare.



Photograph by Fred Bremner

A FRUIT STALL IN THE QUETTA MARKET

Before the British made Quetta an important army post in their line of defenses on the northwest frontier of India, the town was a group of dilapidated mud buildings. To-day it is one of the most popular stations of the Indian army and is the trade mart for western Afghanistan and eastern Persia. This was the objective of the author's automobile journey from Leeds, England, more than 8,500 miles distant by the route traveled.

Many times we had to take to the railway track, and bump over the sleepers. Frequently we moved behind a gang of coolies who cleared a way for us at the rate of about 450 yards per hour.

Twenty times in our last 20 days we came up against difficulties that nearly made us abandon hope, but we fought on until, weary and sore, we arrived on October 24 at our goal—Quetta.

Although we were five and one-half

months on the road, we were running for only 96 days. Of the 8,527 miles covered, 3,000 were void of road or track, 1,500 were over waterless desert, and 100 over seemingly bottomless silver sand. We bumped for 249 miles over railway sleepers, and had to find our way around 150 broken bridges.

Our total bill for spare parts was less than \$14. We used but two sets of tires and had only two punctures.



Photograph by Maynard Owen Williams

AT THE WHEEL OF THE "BOWDOIN"

Commander Donald B. MacMillan, leader of the MacMillan Arctic Expedition, is taking his turn at the helm. In the right background is Dr. Gilbert Grosvenor (in oilskins), President of the National Geographic Society, under whose auspices the Expedition goes into the Far North. At the left is Kennett Rawson, 16-year-old cabin boy, the youngest member of the Expedition. Dr. Grosvenor, who is an enthusiastic yachtsman, accompanied the Expedition from Wiscasset, Maine, to Battle Harbor, Labrador. The 15-ton oil-burning *Bowdoin* is the flagship of the Expedition. The U. S. Navy's personnel and airplanes are carried aboard the larger vessel, the *Peary* (see pages 225 and 226).



Photograph by Maynard Owen Williams

THE THREE NAVY AMPHIBIAN AIRPLANES ABOARD THE "PEARY"

In the right background stands Lieutenant Commander Richard E. Byrd, Jr., in command of the U. S. Navy personnel cooperating with the MacMillan-National Geographic Expedition in a search for land in the unexplored area of a million square miles lying between Alaska and the North Pole.

THE MACMILLAN ARCTIC EXPEDITION SAILS

MEMBERS of the National Geographic Society have been gratified at the exceptional interest shown in the MacMillan Arctic Expedition, which went North under their Society's auspices, with farewell tributes tendered by cities, States, and official representatives of the United States, and also with helpful cooperation on the part of our sister country, Canada, at Sydney, and of the Newfoundland provincial authorities at Battle Harbor and Hopedale, Labrador.

The Secretary of the Navy, Curtis D. Wilbur, has said that he regards the Expedition as the best equipped, both as to material and personnel, ever sent into the Arctic.

Airplanes will explore in days icy areas of the Arctic which would take months to traverse by dog sleds. Radio is telling the daily program of work which in years past would be shrouded in silence for

months. For the first time in Arctic history, color photographers are recording, for members in early issues of their *GEOGRAPHIC*, the surprising tints of the Far North, the native life, birds and many beautiful Arctic flowers.

These new aids to travel and communication enable the Expedition to engage upon a program perhaps of broader exploration and scientific study than any expedition heretofore has attempted.

The flying of the U. S. Navy airplanes under the direction of Lieutenant Commander Richard E. Byrd, Jr., and his splendid personnel not only is epoch-making, but marks an important experiment in aviation that will focus the world's attention. If these air caravels of 1925 find a new continent, their pilots will win a place in the Hall of Fame of great explorers.

New chapters in our knowledge of birds and fish, of interest alike to scientist and sportsman, are being added by the



Photograph by Maynard Owen Williams

THE "PEARY" PUTS OUT TO SEA, WITH THE NAVY'S PLANES STOWED ON THE AFTERDECK

At the foremast flies the National Geographic Society's flag, which has been borne to all parts of the world.

studies of Dr. Walter N. Koelz, chief naturalist of the Expedition.

Information which will help navigate the ships and airplanes of the world is contained in the magnetic, tidal, and meteorological observations of Lieutenant Benjamin H. Rigg.

Another exceptional feature of the Expedition is its sponsorship, noted by Commander Donald B. MacMillan in his farewell message, radioed from Sydney:

"We are fully equipped for exploration and the scientific study of northern lands, with the aid of new methods, such as airplanes, radio, and color photography, and with a support which places all of us on our mettle.

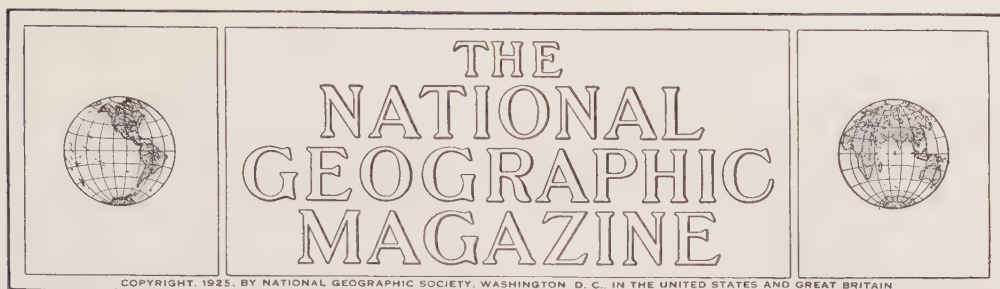
"We are conscious of a high responsi-

bility when the Government gives us its support, and when we set out under the auspices of the National Geographic Society, with its world-wide membership of 1,000,000 enthusiasts for geography and exploration, and when its President, Dr. Gilbert Grosvenor, is here to aid personally in our final preparations."

As soon as possible after the Expedition's return, Commander MacMillan will prepare for the NATIONAL GEOGRAPHIC MAGAZINE an authoritative account of the results of the adventures and achievements of the Expedition. This will be accompanied by the outstanding natural-color photographs and black-and-white illustrations from the 6,000 exposures The Society's photographers are making.

INDEX FOR JANUARY-JUNE, 1925, VOLUME READY

Index for Volume XLVII (January-June, 1925) of the National Geographic Magazine will be mailed to members upon request.



EVERYDAY LIFE IN PUEBLO BONITO

As Disclosed by the National Geographic Society's Archeologic Explorations in the Chaco Canyon
National Monument, New Mexico

BY NEIL M. JUDD

LEADER OF THE PUEBLO BONITO EXPEDITIONS

EVEN in ruin Pueblo Bonito stands as a tribute to its unknown builders. It is one of the most remarkable achievements of all the varied Indian peoples who dwelt within the present United States in prehistoric times.

Pueblo Bonito is a massive communal dwelling — a village within itself — that sheltered, in its heyday, no less than 1,200 individuals. It is a broken pile of once-terraced homes that rose four stories in height and covered ten times more ground than does the White House, in Washington. It is the dead echo of an aboriginal venture in democracy that reverberated throughout our desert regions at least 500 years before Columbus set forth on his memorable journey to the New World.

The National Geographic Society began intensive exploration of Pueblo Bonito in 1921. Each succeeding summer has found The Society's representatives at work there, delving into the secrets of an ancient people who left no written record of their thoughts and experiences. A hundred thousand tons of earth and stone and blown sand have been carted away, revealing a veritable maze of empty rooms in which the former occupants unwittingly left the ineradicable thumbprints of their distinctive culture.

From these material fragments—earthenware vessels, agricultural tools, personal ornaments, and bits of ceremonial paraphernalia—we seek to reconstruct the wordless history of the now-vanished Bonitians. The records are sometimes difficult, sometimes impossible, of interpretation. Again, the story fairly flows from the specimen in hand.

THE ONLY KNOWN NECKLACE OF ITS KIND DISCOVERED

What reader, for example, fails to understand and appreciate that marvelous turquoise necklace recovered by the expedition of 1924? (See Color Plate IV and text, page 246.) Its purpose is quite manifest. The lapidarian skill of its maker, the joy and pride its original owner must have felt in sheer possession of it, are perfectly obvious.

But the reader can scarcely know that an unbelievable amount of labor went into fabrication of this prehistoric jewel; that the rough, unworked stone was obtained only at the cost of great human effort; that the 2,500 beads composing the string were made individually by rubbing small disks of matrix back and forth across sandstone tablets; that each tiny piece was drilled separately with a sharpened flint or some still more pointed instrument.



Photograph by O. C. Havens

REPAIRING THE NORTH WALL OF KIVA Q AT PUEBLO BONITO

The kivas were circular rooms, devoted to religious purposes. Ceremonial requirements placed the kivas at an elevation lower than the living rooms, for they symbolized an earlier world from which the people had emerged onto this earth (see text, pages 248 and 249).



Photograph by O. C. Havens

THE NATIONAL GEOGRAPHIC SOCIETY'S CAMP AT PUEBLO BONITO

During four months of the year this camp, although it seldom contains more than half a hundred persons, is the seventh largest settlement in San Juan County. All provisions for the camp are hauled from the railroad station of Gallup (see map, page 232), 106 miles distant, and even firewood has to be brought from 20 miles away (see text, page 230).

Nor can the average reader accurately measure the inestimable contribution The Society has made to science and history through preservation of this, the only known necklace of its kind in all the world.

Geographical exploration is not always so simple as it may appear from a printed page. Whether it be tracing a precarious path between hissing fumaroles in a Valley of Ten Thousand Smokes, or searching jungle-clad Andean slopes for lost cities of the Incas, or trekking across Tibetan plateaus to visit villages unmarked on the world's recent maps, the explorer must, perforce, adapt himself to his new environment and seek to overcome such obstacles as hinder his progress. Few roses bloom in untamed lands!

Before work could proceed at Pueblo Bonito we sought out and tapped a hidden reservoir of the desert for drinking water. This well immediately became our labor barometer. As its surface rose and fell, the number of men and animals engaged in the explorations was increased or diminished. When hot July winds blew across the mesas to pile the rain clouds

back upon the horizon, we measured our cistern twice a day.

When our Navajo neighbors came in with lard buckets, canvas bags, and even barrels to complain that their water holes were dry, we shared our meager supply with them and agreed that the whole country had been drying up ever since the white men arrived. When they returned later with their goatherds and horses, we clamped on the lid and told them to dig their own wells deeper.

The insufficiency of our water supply has been the chief reason why travelers have been rather discouraged from visiting Pueblo Bonito during the annual excavation season.

CORNER GROCERY IS 106 MILES AWAY

When the gods smiled and work progressed as we wished, thirty-five or more Indians, ten white men, and eight or nine horses were busy in the ruins. During four months out of the year our camp was the seventh largest settlement in San Juan County (see illustration above).

All the provisions for this evanescent village, all the hay and grain for the teams, had to be hauled from the railroad.



Photograph by O. C. Havens

EXCAVATING A KIVA AT PUEBLO BONITO

One hundred thousand tons of earth, stone, and blown sand have been carted from the ruins of Pueblo Bonito by the National Geographic Society's expeditions. When conditions are favorable, thirty-five or more Indians, ten white men, and eight or nine horses are busy in the ruins (see text, page 227).

Firewood was brought from twenty miles away. Mechanical repairs as well as future commissary requirements had to be anticipated.

Our corner grocery at Gallup was separated from our kitchen at Pueblo Bonito by 106 miles of happened-by-chance road. When this road was dry the one-way trip could be made in seven hours; during the midsummer rains our drivers always carried their bed-rolls and a week's rations.

But such local handicaps as Nature imposed were speedily forgotten as each was passed. Delays and disappointments were but temporary. Every day brought its share of work and worry; of secret thought toward maintenance of interest and contentment among our Indian workmen; of planning for the morrow and the week ahead. And every day witnessed some definite progress toward the goal set when these expeditions were inaugurated, four years ago.

Previous reports* of The Society's ex-

plorations at Pueblo Bonito have dealt more with the progress of excavations than with the nature of the discoveries. In these earlier accounts details of investigation, descriptions and interpretations of the cultural material recovered, have purposely been omitted, for it was felt that further research must certainly add to the story of which they formed but a part.

That story has not yet been wholly retrieved, but it is now possible to weave the countless threads of fact and reasonable conjecture into a single fabric of probable truth—to review the daily life of the Bonitians as they lived a thousand years or more ago.

Every potsherd, every fragment of worked stone, has its individual meaning. Our task is the faithful interpretation of this mute evidence; our hope, to breathe new life into these cold, inanimate objects.

In thus weaving the story of a prehistoric people who have left no written records, many loose ends unavoidably remain; a bit of patchwork appears now

* See the NATIONAL GEOGRAPHIC MAGAZINE for June, 1921; March, 1922, and July, 1923.



Photograph by O. C. Havens

THE EAST SECTION OF PUEBLO BONITO

This aboriginal apartment-house covered more than three acres of ground, stood four stories in height, and contained not less than 800 rooms (see text below).

and then, but the basic warp is mostly fact and strong enough to stand the supreme test of close and searching inspection.

PREHISTORIC BONITIANS LIVED LIKE MODERNS

Life in prehistoric Bonito was surprisingly modern. It was both strenuous and complex; yet it remained simple, withal. It witnessed the coming together of at least two distinct groups of people and their subsequent development of perhaps the most extraordinary pre-Columbian settlement north of Mexico.

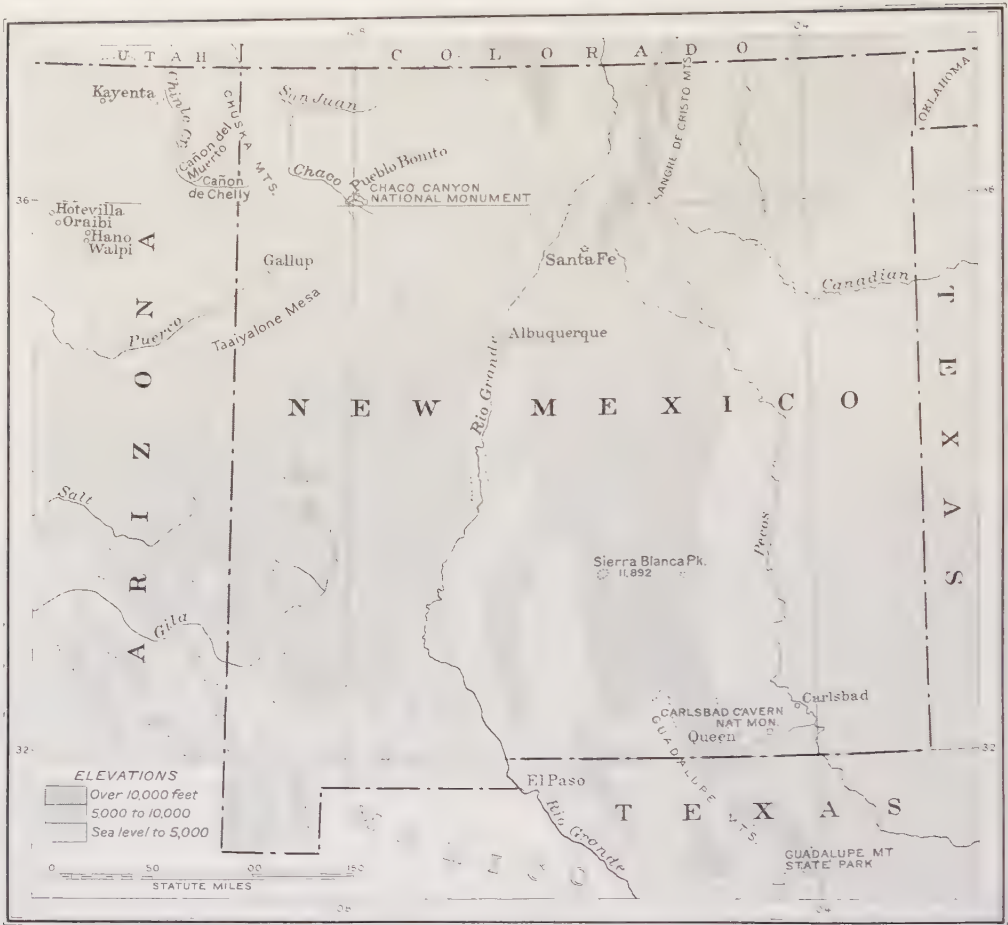
The daily struggle for existence was paramount then as now, and each inhabitant of the village, old and young alike, necessarily contributed his share to the support of the community as a whole.

That the Bonitians eventually lost in this struggle is no just argument against their diligence, their capacity as coloniz-

ers, or their skill as agriculturists. It means only that their highly organized form of community life, their particular brand of socialism, was not adapted to the environment of Chaco Canyon.

The ancient Bonitians were back-yard farmers. They dwelt in a compact village—an aboriginal apartment house, if you will—covering over three acres of ground, standing four stories in height, and containing fully eight hundred rooms. No other apartment house of comparable size was known in America or in the Old World until the Spanish Flats were erected in 1882 at 59th Street and Seventh Avenue, New York City.

Desert plants furnished edible seeds and skilled hunters brought occasional game from distant mesas. Nevertheless, the principal source of the Bonitians' food-supply lay in their neighboring garden plots, where corn, beans and squash—



Drawn by James M. Darley

A SKETCH MAP OF NEW MEXICO AND EASTERN ARIZONA

In the northwest corner of New Mexico is the Chaco Canyon National Monument, within which is Pueblo Bonito, scene of five years of exploration by the National Geographic Society. Just across the State border lies the Cañon del Muerto (see Earl H. Morris' article in this number of the NATIONAL GEOGRAPHIC MAGAZINE). At the foot of the Guadalupe Range, in the southeast corner of New Mexico, is Carlsbad Cavern, scene of labor of another National Geographic Society expedition (see pages 301 to 319).

staple foods of our prehistoric, sedentary Americans—were intensively cultivated. And, if we may judge by modern Pueblo practices, the colorful clan ceremonies periodically performed by these farmers of the long ago had for their fundamental purpose the propitiation of tribal gods to the end that more bountiful harvests might be brought about.

THE WIFE WAS THE HEAD OF THE HOUSEHOLD

Historians of the Old World offer convincing argument that irrigation originated on the sandy borders of the Nile

and the Euphrates. Whether this be true or not, it is well known that similar methods of crop production were developed in our own arid Southwest by Indians who had never heard of the Egyptian Pharaohs or the splendors of forgotten Babylon.

Irrigation was practiced by the people who lived at Pueblo Bonito. We know this, and yet positive proof is lacking. No definite trace has yet been found there of ditches or *acequias* for the distribution of water. Canals were hand dug by the primitive farmers of the Gila and Salt River valleys, in southern Arizona, long before Coronado led his *conquistadores*



Photograph by Charles Martin

THE HOPI VILLAGE OF WALPI, ARIZONA

Walpi (the Place of the Notch) is one of the oldest of the still inhabited Hopi villages. It was one of the group of towns visited by the Spaniards in the middle of the 16th century, when they first came to know of this tribe. It is probable, however, that the old pueblo of Walpi was abandoned about 1680 and the present one established on the near-by mesa.

northward out of Mexico in 1540, and these very same canals are now used, in part at least, by white settlers of the region.

But in Chaco Canyon different methods obtained, since without living streams canals were scarcely feasible. Flood waters that roared down from the mesas following torrential midsummer showers were caught by low ridges of earth surrounding even the smallest inclosures, sometimes only a few yards square, wherever corn and beans would grow. By this system of inundation moisture was concentrated in the cultivated areas.

Because water is such a fugitive blessing, the present Indian population of the northern desert country has likewise learned the wisdom of using flood irrigation. The Hopi, Zuñi, and Navajo all profit to-day through the hard-won experience of their forefathers (see p. 260).

In prehistoric Bonito there existed a curious division of domestic responsibility. "Woman's Rights" were already recognized and in vogue. The head of the Bonitian household was the wife and mother, not the husband. Times have changed since then, but history tends always to repeat itself! Bonitian fathers



Photograph by Neil M. Judd

ZUÑI BOYS CARRYING A GREAT LOG AFTER THE STYLE OF THE ANCIENT PEOPLE:
PUEBLO BONITO

The Bonitians were great housebuilders, and, while the homes were owned and partly built by the women, the men felled and transported the huge roof timbers and placed them upon the walls. A tremendous amount of labor must have been necessary to bring these great trees from forests many miles away (see text, page 248).

had the responsibility of providing for their families, yet the women owned their homes and brooked no interference in purely domestic affairs.

Among primitive sedentary peoples this has always been true. Man reigned supreme out of doors, in the chase, for example, or in the fields. The corn was his so long as it remained unharvested, but once dried and safely stored in the dark, inner rooms of the place he called home,

possession passed automatically to his better half. At her direction only it was doled out and crushed in the family meal-ing bins.

GRINDING STONES INHERITED FROM
ANTIQUITY

Step into almost any Pueblo home of to-day and you will find *metates* (grinding stones) powdered with freshly ground meal. These characteristic stone



/ Photograph by O. C. Havens

THE PUEBLO BONITIANS' PUNY EFFORT TO BRACE A MIGHTY CLIFF

This seemingly precariously balanced mass of rock stands just above Pueblo Bonito. The Bonitians naïvely erected sticks and stones to hold back its 100,000 tons of solid rock that threatened to topple upon their village (see text, page 260).

mills have been inherited from remote antiquity. They were utilized alike by cliff-dwellers, occupying caves in the sheer-walled canyons of the Colorado drainage, and by equally ancient peoples who erected huge clay houses on the flat, cactus-covered plains of the Gila.

Indeed, with but slight variation, they were, and still are, used by the Indian populations throughout Mexico, Central America, and the countries below the Isthmus of Panama. What traveler south of the Rio Grande has not heard the rhythmic sound of the tortilla-maker

echoing on the clear, cool air at day-break?

So in Pueblo Bonito a daily task for the daughters of every household was the preparation of the allotted ration of maize. Metates were brushed with a bunch of grass; the corn was shelled and crushed to a degree of fineness dictated by the particular use for which it was intended.

And while precious yellow kernels were being crunched between the milling stones, black-eyed maidens shyly gossiped of promising village swains or sang such



A BEJEWELED SKELETON AT PUEBLO BONITO

Such lure as the turquoise bracelet on this skeleton caused many of the graves of Pueblo Bonito to be opened by grave-robbers centuries ago (see text, page 245).



Photographs by O. C. Havens

THE RESTING PLACE OF AN ANCIENT BONITIAN

It is from such mortuary offerings as these that many of the most important relics of Pueblo Bonitian civilization and culture have been recovered. Note the planting sticks at the feet of the skeleton in the foreground and the four small hematite cylinders immediately above its head.



Photograph by O. C. Havens

DISTURBED BURIALS AT PUEBLO BONITO

Prehistoric peoples of the Southwest sometimes interred their dead in rooms of the village. This was done at Pueblo Bonito, but many of the bodies so buried were disturbed by grave-robbers long ago (see text, page 245). Note the elaborately decorated pottery.

pleasing grinding songs as I have often heard through open doorways at Zuni.

Excepting the present generation, which has been somewhat schooled in the ways of the white man, Pueblo peoples have changed but little since the very dawn of their socialistic form of self-government. Tradition connects them with the cave-dwellers and the occupants of storied communal houses in the wide desert spaces; the customs of these prehistoric town-builders are often reconstructed through knowledge of modern Pueblo life.

THE PUEBLO WOMAN'S WORK WAS NEVER DONE

Some few of us still believe in the old saw, Man works from sun to sun, but woman's work is never done. Although

I am reasonably confident this time-worn adage did not originate in Pueblo Bonito, surely it was never more applicable than to the daily life of that ancient community. Indian-like, the inhabitants were up at break of day to greet the new sun as it peeped over the canyon rim and caressed with its long fingers the flat roofs of the topmost dwellings.

Shortly thereafter the menfolk turned to their fields, to pursuit of deer that had ventured too close, or to forested slopes where beams and ceiling poles were felled and barked. At the same time the women resumed the unending and varied tasks of their households.

There were skins to tan, dyestuffs and clays to fetch, pots to fashion, and blankets to weave. Such fragile stuff as cotton cloth rarely survives the passing cen-



Photograph by O. C. Havens

AN EXCAVATED ROOM IN PUEBLO BONITO

The Bonitians were expert workmen, for their mud plaster has clung to the walls for centuries. Note the figure in the passageway which leads to another room.

turies, but fragments have come to light from time to time—plain white fragments, fragments with colored designs and much-patched fragments.

Sandals were plaited from split leaves of the yucca or woven from its tough fibers. Baskets of many shapes and sizes were built up, coil upon coil, by skillful fingers.

BONITIAN GIRLS ROUGED THEIR CHEEKS

A Pueblo Bonito home, for all the simplicity of its furnishings, was a busy place. It was dwelling and workshop combined. And all the various materials required for each day's activities had to

be gathered in the proper season for each, prepared and stored for future use.

Whether at work or play, the Bonitian women, as well as their menfolk, sought to improve upon the imperfections of Nature. They brightened their bronzed cheeks with a little touch of rouge. Not the Princess Pat, the Tangerine, the Ashes of Roses, so popular in the parks to-day, but good, old, reliable brick-red rouge, dug from the thin lenses of compact clay underneath the sandstone cliffs. Our Zuñi boys begged every fragment we came upon in the excavation and laughingly streaked their faces with it; Navajo horsemen frequently rode into camp as



Photograph by O. C. Havens

WHERE THE RICHEST FIND AT PUEBLO BONITO WAS UNEARTHED

This remarkable necklace, containing 2,500 separate beads of turquoise and four pendants, represents an almost unbelievable amount of labor on the part of the ancient lapidary who fashioned it (see text, page 227, and Color Plate IV).

brilliant as an autumn sunset, their faces painted against the reflected heat of the desert sand.

PUEBLO BONITO POTTERY IS THE FINEST
MADE BY PREHISTORIC PEOPLES

Members of the National Geographic Society will readily understand that, after having stood roofless under the rains of summer and the snows of winter for approximately one thousand years, Pueblo Bonito has not yielded examples of all the arts and crafts once produced within her now moldering walls. Many objects have long since disappeared; others are so

fragmentary as to resist accurate interpretation. But of all these varied artifacts I know of none which has come down to us in anything like the number of pieces, as pottery.

Pottery was unconsciously elevated to the high plane of a fine art at Pueblo Bonito. Nowhere else in all the United States are earthenware vessels of ancient times found which surpass those of Chaco Canyon in beauty of form and decoration. The tracing of thin black lines over highly polished white surfaces, in patterns rarely if ever exactly duplicated, gave obvious joy to the Bonitian



Photograph by O. C. Havens

AN OPENED GRAVE: PUEBLO BONITO

Note the shafted arrows (central foreground) buried with this ancient Bonitian for his use in the "Happy Hunting Ground."

housewife. Without love for her handiwork, without justifiable pride in her skill, she never could have created such masterpieces (see page 237).

The pottery of Pueblo Bonito stands at the very apex of ceramic achievement among the prehistoric peoples of our country.

Those who have visited Pueblo Bonito and spent hours of meditation within the shadow of its broken walls find it easy to picture these women of the long ago at work with their clays and crude shaping tools. One sees them sitting in the soft light of their earth-floored dwellings, grinding and kneading and rolling into long strips clays which had been selected with great care and often transported from a distance.

The potter's wheel was not known to any of the aborigines of the New World; it is an Old World invention; but a rude substitute—a shallow basket or the bottom of a broken olla—was occasionally employed in New Mexico and Arizona as a movable worktable upon which the new vessel was fashioned.

Dwellers in the cliffs made basket receptacles before they discovered the art of pottery manufacture, but they retained in the latter industry the technique of the former. Thus it is that a Pueblo woman, even to-day, builds up a bowl or jar with long ropes of plastic earth, pinching each successive coil to firm union with its predecessor, smoothing down the rough surfaces with a bit of wood or gourd rind and later polishing the whole with a water-worn pebble (see page 248).

FINGER PRINTS PROVE SMALL CHILDREN WERE TAUGHT POTTERY MAKING

Youthful hands often helped shape new vessels to replace those broken on the hearth. Every woman had to learn the potter's trade, and her schooling began early. In fancy, I see brown-bodied little tots studiously striving to duplicate the products of their mother's hands; I hear words of encouragement uttered to soothe the impatience and failures of childhood.

In the ruins of Pueblo Bonito we have found rude, miniature ladles and pitchers bearing the imprint of baby fingers; we



Photograph by O. C. Havens

WHERE GRAVE-ROBBERS HAVE LEFT THEIR MARK

have unearthed toy bowls, shaped and painted by skillful hands to serve as object-lessons for restless beginners. And how simple the task must have seemed, in these models lovingly prepared!

YOUTHFUL PUEBLO BONITIANS HAD MANY PETS.

Childhood in Pueblo Bonito did not differ greatly from that of our own time. It had its tragedies and its joys. Only the environment varied.

In their everyday life, the prehistoric toddlers of Chaco Canyon were not especially humored by their parents. Their childish desires were simple and easily satisfied. A cottonwood stick wrapped with a skirt of cedar bark or a cotton rag served as a doll. A knotted yucca leaf, a potsherd, or a feather on the end of a string became toys for a time.

Pets, too, there were. Coyote pups to romp with and maul about; tethered ground squirrels, perhaps, and rabbits galore. Eagles and red-tailed hawks moped in wickered cages; imprisoned turkeys begged crumbs and sunflower seeds. Brilliant macaws from the tropical forests of Mexico—treasured clan totems, safely

guarded by ritualists of the kiva—could not but excite the wonder and admiration of youthful eyes.

And then there were always bright-colored stones to be counted and recounted and hidden again; butterflies to chase in summer and daubs of mud to throw when other amusements wearied.

But daytime was not all playtime for the children of Pueblo Bonito! Little girls must needs tend still smaller brothers and sisters or assist in the ceaseless duties of the home; little boys had their share of work in the fields, planting seeds in early springtime and, later, nursing each individual plant through the hot months, until seasonable rains brought new life to parched gardens.

Turning over hard, dry soil with sharp sticks was no easy task, even for full-grown muscles; pulling prickly weeds made hands sore; guarding fields from destructive pests was a never-ending chore. Worms had to be hunted out and killed, lest the harvest be reduced through their insatiable appetites.

At times grasshoppers came in countless hordes to eat the tender green leaves through which growing plants feed. And



AN ART SCHOOL

The arts and crafts known to the Zuñi have been very effectively handed down from one generation to another in such schools as this.



Photographs by Charles Martin

INDIAN MILLERS

The *metates* or grinding stones used by the Zuñi in making meal are very like those used in Pueblo Bonito. These stone mills are an inheritance from remote antiquity and have been utilized by primitive peoples in many parts of the world (see text, page 234).



Photograph by O. C. Havens

A HOPI KACHINA MAKER

The Hopi religion takes into account innumerable subordinate supernatural beings known as "kachinas," a term which refers to the inherent magical powers for good or bad attributed to every natural object. Many of these kachinas are personalities of clan ancestors, while others are beings of unknown significance, but possessed of magic powers. Each kachina is endowed with individual characteristics and is represented in at least six different symbolic colors.

those thieving rascals, the crows, required constant watching. They would scratch out newly sown seeds, pull up the young sprouts, strip ripening ears of their milky kernels, or rob the mature stalks of their grains. Nothing so delights a crow as an unprotected cornfield!

HUMAN WOLVES PREYED UPON PEACEFUL PEOPLE

But there were other and more dreadful enemies to guard against. Human wolves crept in through autumn shadows to prey upon the village and steal all that could be carried away. From far across the mesas these pillagers came. We do not know who they were, nor how far they traveled, but we do know they came.

Nomads they were; hunters by instinct and rovers by preference. To them, such sedentary, home-loving folk as the Bonitians were fair game; to them, corn ripening in the fields or drying on the rooftops was a prize well worth striving for.

Lone workers in the gardens were slain

seeking shelter; boys and young women were taken captive and dragged away as slaves of the invaders.

No witness of these periodic attacks remains; no record of them was ever written. But similar strife between sedentary and nomadic peoples has been waged since man became man; it forms a considerable portion of the world's history. The depredations of Geronimo and his outlaw band are yet a vivid memory along the Mexican border. Old men still resident in Zuñi and in the Hopi pueblos, as boys, have lived through raids by mounted Navajo; have seen their playmates slaughtered, their sisters stolen, the goats and sheep they tended decimated or driven away, and piles of ripened corn loaded on mules for transport to distant camps.

Such brigandage continued unchecked during the Spanish and Mexican occupancy of the Southwest; it was brought to an end only through American efforts during the second half of the 19th century.



MAKING A PEACH BASKET

For the harvest the Zuni women weave deep, sturdy burden-baskets which have a capacity of about a bushel. They are made largely of skunk-bush shoots.



Photographs by O. C. Havens

NAMPEYO, MOST FAMOUS OF MODERN PUEBLO POTTERS

The Pueblo people of the Southwest are to-day, as in the past, masters of the ceramic art. This Tewa squaw of Hano Pueblo, Arizona, is holding one of her masterpieces.

The earliest known description of Pueblo Bonito and its neighboring ruins was written by Lieut. J. H. Simpson, attached to Colonel Washington's command on a punitive expedition against the Navajo in 1849; and the southern Apaches were not completely subjugated until a much later period.

It would indeed be interesting could we learn what enemy tribes worried the prehistoric Bonitians. That their attacks were relentless and recurrent has been established by The Society's expeditions. The single gateway to Pueblo Bonito was reduced to a narrow door, and this was subsequently and permanently closed in the interest of still greater security. Thereafter, access to the great house was gained by a ladder which, in time of necessity, could be drawn up to the rooftops.

INHABITANTS FORCED TO SEAL THEIR DOORS AND WINDOWS

Doorways and elevated windows in the curved outer wall of the pueblo were all closed with masonry long before the village was finally abandoned. Without deep-rooted fear of savage marauders, these precautions would never have been taken. With the passing years the Bonitians drew more and more within the shell of their pueblo, as a tortoise, when threatened, retires within its carapace.

But even closed doors and a blocked gateway did not entirely shield these ancient folk from their enemies. The latter, gaining confidence from repeated successes, returned to the attack with ever-increasing frequency.

Peaceful villagers are no match for trained warriors. Hand-to-hand struggles were waged in the very courts of the village; hafted stone axes and wooden war clubs bruised brown bodies and broke many a bone; flint-tipped arrows sought out crouching defenders of the terraced houses. Terrifying war cries echoed through the canyon; fearful women hurried weeping children to the shelter of inner rooms.

Again, we may only surmise the general fact of such sporadic warfare, since no definite proof of it has come down to us. The Bonitians kept no diary of passing events and the glyphic carvings they

pecked on the cliffs remain mostly unintelligible. But similar defense against hostile tribes within the past century was forced upon the various Hopi towns of Arizona, upon the Zuñi of western New Mexico, and the Tewa of the Rio Grande.

Final abandonment, in 1838, of Pecos—the largest Pueblo village visited by Coronado on his expedition in 1540—was a direct result of relentless attacks by Comanche war parties from the Texas plains. And like conditions almost certainly obtained during the occupancy of Pueblo Bonito, if we may judge from the circumstantial evidence at hand.

SEVENTY-ONE BODIES FOUND, VICTIMS OF GRAVE ROBBERS

Not only did these unknown marauders execute systematic and periodic raids against the Bonitians, killing the men when possible, stealing their women and children, and plundering their fields, but they even pillaged the burial chambers.

Prehistoric peoples of the Southwest sometimes interred their dead in rooms of the village. Four such rooms have been found in Pueblo Bonito.

Of the seventy-one bodies buried there, most had been wantonly disturbed at a time shortly before, or shortly after, the village was deserted by its builders. If the former, we may be sure the defenders had been so reduced in numbers as to be well-nigh helpless against their enemies. Herein lies one possible reason for the abandonment of Pueblo Bonito.

In these four chambers a most astonishing condition was found to prevail. Skulls had been tossed aside; arms and legs had been torn from desiccated bodies that lay crushed on their burial mats; toe and finger bones, ribs and vertebrae, were scattered in hopeless confusion; mortuary offerings—baskets, earthenware vessels, and implements formerly used by the deceased—had been overturned and trampled upon (see pages 236, 237, 240, 241, 255).

And the cause of all this destruction? Hasty, vandalistic search for turquoise or other treasured ornaments buried with the dead (see page 239).

WEALTH RECKONED IN TURQUOISES

Nothing was more highly prized than the turquoise by the Pueblos of a thousand



A ZUÑI SMILE

Photograph by O. C. Havens

Like most of the other Pueblo tribes, the Zuñi are quiet, good-tempered, industrious, and friendly.

years ago, as by their descendants of today and the latter's near neighbors, the Navajo. Turquoise, symbolic of the blue desert sky! Turquoise, whose soft colors embody the spirit of the vaulted heavens and the restless expanse of mystic oceans!

Indians of the mesa country are rated not by the number of their horses, their sheep, or their goats, but by the amount and perfection of their turquoise possessions. Turquoise to the southwestern Indian is as the diamond to city-dwellers. A pendant worth \$10 by weight will, if its color has been tested through long use, buy 100 goats or 30 ponies. Perfect stones from prehistoric ruins are priceless.

When the Expedition's incomparable necklace first came to light, every Indian on the force dropped his shovel and hurried to peer over the wall. The Zuñi boys lost interest in the excavations; the Navajo lost their fear of the evil spirits that hover about burial places. All draped themselves over the insecure walls to watch what was going on in the deep room below.

Our original Americans possess some mysterious means of radio communication—a highly developed mental telepathy—or a method of transmitting thought that still defies detection. Let some important event take place and every Indian for miles about seemingly will know of it before you have a chance to send word to him.

And so it was with the necklace. Five minutes after my hand trowel had cut away the covering of earth

to reveal this most unexpected and magnificent discovery, every one of our workmen was there as an inspector of operations.

It was impossible to gage their inner feelings. They talked in whispers. Silently they watched our tiny brushes sweep away the particles of earth and sand. And when at last the blue stones shone forth in all their ancient splendor, such subdued exclamations as rose from our audience; such obvious admiration; such reverence, almost, with which they looked upon this treasure of a thousand years ago! (See Color Plate IV.) And a happy boy it was who received the task of removing the specimen.

Turquoise deposits in New Mexico and Arizona have been worked since ancient times and at least one of them furnished the Bonitians with their matrix. Possession of such deposits gave great prestige to a community, for the mineral frequently served as a medium of exchange. The famous Tiffany mines at Los Cerrillos, south of Santa Fe, are still claimed by the Indians of Santo Domingo.

Fray Marcos de Niza, setting forth from Culiacán in 1539 to search out the fabled "Seven Cities of Cibola," met Mexican Indians returning from the north with *chalchihuitl* purchased with feathers from tropical birds. Even in olden times the treasures of one region were more highly valued by the residents of another.

WOMEN BUILT AND OWNED THE BONITIAN HOMES

The wealth of Pueblo Bonito was widely famed in prehistoric days. It brought venders of parrots from Tamaulipas and Vera Cruz; it prompted native dealers in sea shells to the difficult and dangerous foot-journey eastward from the Pacific; it tempted nomadic desert folk to recurrent and devastating attacks. Although a thousand years have passed since Pueblo Bonito was in its heyday, it is still venerated, at least in Navajo tales, because of the jewels worn by its builders.

But the Bonitians themselves were not lost in idle ostentation. They have left too convincing a record of their industry, their tireless energy, their lack of content



Photograph by O. C. Havens

A TURQUOISE DRILLER

For ages turquoise has been the highly prized treasure of the Indians of the Southwest.

with existing things. On festive occasions, when dancers marched from the kiva publicly to invoke aid of the rain gods or to give thanks for successful harvests, the finest raiment of the villagers was displayed; at other times bare backs bent to numerous and arduous tasks.

Among all the diversified activities of Pueblo Bonito, few were more persistently practiced than that of house-building. Like the proverbial beaver, the Bonitian was always busy; but, unlike the beaver, he seems rarely to have been satisfied with his own creations. Just why this should be, it is impossible to say. It may well have resulted from the inevitable



Photograph by O. C. Havens

ROLLING CLAY COILS FOR POTTERY

After the base of a pottery vessel has been formed, a small ball of clay is rolled between the palms into a thin rope, and this is then coiled round and round the edge of the gradually growing bowl or jar. At frequent intervals the potter smooths the receptacle inside and out with a bit of gourd shell (see text, page 239). The potter's wheel was not known to the aborigines of America.

conflict between secular and ceremonial ambitions.

With increasing population, there came a need for more and more dwellings; also for larger or additional kivas, the circular, subterranean rooms inhabited by unmarried men and utilized by the several fraternities or religious societies.

The dwellings, be it remembered, were the recognized property of the women. When a man married he went to live with, or near, his wife's people. This is an old, established custom among the modern Pueblos—a custom which has survived the fleeting centuries and the abrading influences of a dominant civilization.

CEREMONIAL KIVAS BUILT BY THE MEN

The women not only owned, but they also built, their homes—another Pueblo custom which has persisted to within the present generation. Of course, the men participated in this work. They quarried and transported the stone; then fetched the huge roof timbers and seated them

upon the walls. But the houses, nevertheless, were the exclusive property of the women.

In direct contrast, the kivas were owned and occupied by the men-folk. It seems entirely plausible that the members of the several masculine societies joined hands in building their respective lodge rooms. If we could be absolutely certain of this point, it might explain the fact that kiva masonry is invariably inferior to that of the dwellings proper. We must assume, perforce, that the women of Pueblo Bonito were better masons than their husbands.

Because the welfare of the entire community depended upon the faithful performance of prescribed rituals, the influence of the ceremonial chamber was stronger than that of the home. We have noticed repeatedly, during exploration of Pueblo Bonito, where two or four adjoining rooms were sacrificed to provide space for a single kiva. In such instances the partition walls only were razed, leaving



Photograph by O. C. Havens

YOUNG MOTHERS OF A ZUÑI PUEBLO: NEW MEXICO

All of the Pueblo people are monogamists, and the status of women is much higher than among most Indian tribes, although marriage is effected with little ceremony and divorce is lightly regarded.

those opposite to form an inclosing square for the circular structure.

The purpose of this arrangement is easily understood. Ceremonial requirements placed the kiva at an elevation lower than the living rooms, for the kiva symbolized an earlier world, which man reached on his rise from a more primitive state and from which, in turn, he emerged into this world of the present.

To provide new kivas at Pueblo Bonito without encroaching upon the two courts or plazas where public ceremonies were presented, the men turned toward the residential area immediately surrounding the plazas. We may suspect vigorous,

though temporary, feminine opposition to this infringement. But established religious rites formed the very hub about which the daily life and hopes of the whole village revolved.

NO WEALTHY GROUP IN ANCIENT
DEMOCRATIC COMMUNITY

It was but natural, therefore, that religious necessity should prevail, and that mere dwellings should give way to ceremonial chambers. Inclosing walls were left standing about these kivas merely to simulate the required subterranean position of the latter.

In spite of the large number of their



Photograph by O. C. Havens

BAKING CORN CAKES

These thin disks of bread, known as *piki*, form a staple of diet of the Southwestern tribes. They are being cooked on a hot stone slab, just as the Bonitian housewives must have cooked them a thousand years ago.



Photograph by O. C. Havens

A GIRL WEAVER

Like their neighbors the Hopi and the Navajo, the Zuñi are skilled weavers of blankets and belts. Their textile work is durable and shows great variety of design. The Navajo blanket has become one of the most popular articles of Indian handicraft.



Photograph by O. C. Havens

PREPARING BASKETRY FOR REMOVAL FROM THE RUINS OF PUEBLO BONITO

These relics, which have lain buried for a thousand years or more, must be carefully handled if they are to be taken intact from their resting place and deposited in the National Museum, Washington, as a loan collection from the National Geographic Society.

ceremonial rooms and the probable influence of their priestly groups, the Bonitians were a democratic people. They granted no special privileges. Among all the rooms of Pueblo Bonito, no single dwelling can be pointed out as the home of the most influential. Each inhabitant had work similar to his fellows.

Head men were no doubt selected periodically and for definite terms of office, as with the Pueblos of to-day. We find no evidence to the contrary. Representative government prevailed; clan leaders and designated members of the secret so-

cieties made up the town council, and this body, in turn, chose what we might properly term the mayor, decided factional disputes, and apportioned the arable lands.

Living quarters, except for insignificant variations in size, were singularly alike. Masonry walls, usually plastered with adobe mud, rose from clay floor to beamed ceiling. Wall pegs supported casual garments, while shallow niches held such lesser objects as flint knives, personal possessions, and the bone awls and sinew used constantly in sewing.

Tanned skins and blankets of rabbit fur, neatly piled to one side during the day, were spread out on the bare floor as beds at night. A tuft of eagle feathers, suspended from the ceiling, protected the household from evil spirits, as it swayed gently with the soft movement of air through the rooms.

Generally speaking, ventilation is no great concern of aboriginal

peoples; and yet, unlike other prehistoric house-builders of the Southwest, the Bonitians provided for it by leaving squared openings in the upper walls of their dwellings. Thus was fresh air conveyed to the dark, inner rooms, where corn and other foodstuffs were stored between harvests.

But crotchety old men apparently complained of the drafts caused by these ventilators, for we have found many of them partially or wholly closed, and in the outer wall of the last addition to the village no openings of any sort occur.

Now, it is a curious fact that very few rooms in Pueblo Bonito contain fireplaces. They are present in the older portion of the village; more rarely in the newer.

THE KITCHENS WERE ON THE ROOF

Cooking was done in the open courts; also on the flat roofs of the houses, for most of the inhabitants dwelt in second, third, or fourth story suites. The tempting aroma of a rabbit stew boiling in an earthen pot, of green corn or antelope ribs roasting on hot coals, drew hungry lads from their play and proud fathers from the serious business of community affairs.

A common fallacy, too widely current among the reading public, is that our American aborigines are dirty and unkempt. While this is true of some of the more nomadic tribes, it will not hold for all. The average Indian, living in his natural environment, may have standards that differ somewhat from our own, but he is as clean as need be, both as to his person and his surroundings.

The Hopi, Pima, and Papago, for example, not only sweep their houses, but their dooryards as well. I have no hesitancy about sitting down on the earthen floor of a Zuñi home to share with my hosts a meal in which knives and forks play no part.

Bonitian wives were equally good housekeepers. With a hand broom of dry grass they regularly brushed their living quarters; then sprinkled the floors anew with



Photograph by O. C. Havens

HOW ANCIENT BASKETS WERE FOUND AT PUEBLO BONITO

Only the extremely dry climate of the Southwest has made possible the preservation of these fragile relics of a long-vanished people. Their preservation after excavation is an intricate and delicate undertaking.

water that the clay might become smooth and hard-packed. Their husbands, on the other hand, were a bit careless. We often find in the kivas, where women were not permitted, that an entirely new floor was spread to conceal an accumulation of dust and ashes. Sometimes several of these pavements appear, one close upon the other.

It, perhaps, ill becomes an anthropologist seriously to criticize the domestic habits of those he studies; but I find one outstanding fault with the housekeepers of prehistoric Pueblo Bonito: They were



Photograph by O. C. Havens

TAAIYALONE MESA, WITH A ZUÑI PUEBLO IN THE FOREGROUND

The famed "Seven Cities of Cibola" have been definitely identified with the seven pueblos of the Zuñi. When Coronado reached them, in 1540, he found, much to his chagrin, only a group of ordinary Indian pueblos with none of the reputed wealth. The principal of these pueblos, Hawikuh, he stormed, the Zuñi fleeing to Taaiyalone Mesa, their retreat and stronghold in time of danger.



BURIALS AND MORTUARY OFFERINGS IN PUEBLO BONITO

From time immemorial it has been the custom of the American Indian to bury with his dead certain articles for use in the spirit land. These included bowls, baskets of food, smoking material, jewelry, and ornaments, weapons, and agricultural implements.



Photographs by O. C. Havens

BUFFALO DANCERS

Animals and animal spirits play a large part in the ceremonial life of the American Indian. To buffalo, bear, wolf, antelope, and various birds and serpents supernatural powers are ascribed and in their honor dances and other ceremonies are performed.



Photograph by O. C. Havens

THE WORK OF WIND AND SAND IN CHACO CANYON, NEW MEXICO

Upon this massive boulder the elements have chiseled an inscription telling of their power.

too thorough. A beautiful jar, hopelessly shattered through an unfortunate accident, was discarded without any consideration for future archeologists.

The larger fragments were gathered up and thrown on the village rubbish pile or into some convenient, abandoned dwelling; the lesser pieces were removed with the daily sweepings. And I have sometimes thought while searching for lost parts of a particularly charming vessel, that all the pieces had been carefully divided at the time of the accident into half a dozen or more fairly equal piles, and that these in turn were then handed to the several youthful members of the household and sent to the four cardinal points, there to be cast on wholly separate and distinct trash heaps. If Bonitian wives had deliberately set about rousing the archeological ire, they could have found no more certain means than this.

THE ANCIENTS WERE CONSTANTLY REBUILDING

One of the most astonishing discoveries yet made in the ruins of Pueblo Bonito is the amount of reconstruction under-

taken during the period of occupancy. It is difficult to measure the full extent of this work and utterly impossible to identify all the influences which prompted it. Houses were torn down and replaced; partitions were built in; walls were changed and new levels established. First-story ceilings were braced to receive the additional weight of later rooms erected above.

Fully 30 per cent of the dwellings in the newer portion of the pueblo overlie the remains of unfinished or partially razed structures. On the outer northeast quarter of the village, there is a veritable maze of interlaced foundations that never supported the walls for which they were prepared. An enormous amount of labor was involved here. What operated to change the intentions of the builders?

It now appears that plans for a considerable addition to the village were suddenly altered after the work was well under way, and that the proposed outer tiers of rooms were drawn in to their present positions. Final solution of this puzzle, it is hoped, may follow additional excavations which are now in progress.



A COMANCHE WAR DANCE

The Comanche came into the Pueblo country from the north, where they were long noted as the finest horsemen of the plains and bore an enviable reputation for dash and courage. They are well built, possessed of a high sense of honor, and hold themselves superior to the other tribes with which they are associated.



Photographs by O. C. Havens

A ZUÑI CORN-GRINDING DANCE

This ceremony was a part of the intertribal Indian festivities held recently in Gallup, New Mexico.



Photograph by O. C. Havens

A HOPI HAIRDRESSER

Unmarried girls among the Hopi part their hair in the middle from the forehead to the nape of the neck, and arrange it in a large whorl above each ear, a very distinctive style symbolic of the squash-blossom. However, as the girls become educated this picturesque fashion is fast disappearing.

Those members of The Society who have followed the Pueblo Bonito explorations will recall that several types of masonry are visible in the ruin. The oldest and crudest of these is confined to the north and northwest sections; it is characteristic of a separate settlement of long standing and of irregular outline—a settlement which formed the nucleus of the great, terraced village we now call Pueblo Bonito.

The inhabitants of this older section were the original Bonitians. They formed a somewhat decadent community, since but few additional rooms were erected by them after their number had been increased by a larger group of near-strangers, who, having arrived by invitation, began to rebuild the town to suit their own fancies

NEWCOMERS WERE MASTERFUL
PROGRESSIVES

Abandoned dwellings of the old village were razed and replaced; in fact, the new structures, following more or less definite

plans, actually absorbed and encompassed the older settlement.

These newcomers were progressives; they were masterful. To them we owe the far-famed Pueblo Bonito of later years, the Pueblo Bonito whose marvelous ruins now form a pass-key to that wealth of prehistory locked in the sands of our Southwestern States; whose very name—the City Beautiful—signifies the admiration in which it was held by another people living in another age.

These late arrivals were skillful potters, master builders, hewers of stone and wood. They erected retaining walls around the village refuse piles just to keep the potsherds and ashes from scattering too widely. They went unknown distances to fetch, upon their bare shoulders, the hundreds of heavy pine logs required in the houses they piled one upon another.

They changed, altered, and enlarged their pueblo with utter disregard for the physical labor involved. What they willed to do they did. They even had



Photograph by O. C. Havens

A DRUMMER OF ORAIBI

The Hopi are clever at making masks and other ceremonial paraphernalia from hides. On the shelf above the drummer's head are masks with their faces to the wall. Southwestern pueblo tribes enjoy long-drawn-out ceremonies, of which the Hopi have thirteen, each lasting nine days. Oraibi is the largest and most important of the villages of the Hopi, in northeastern Arizona. Before the establishment of a Spanish Franciscan mission here in 1629 it was said to have had 14,000 inhabitants.



Photograph by O. C. Havens

AN INDIAN TERRACED GARDEN: HOTEVILLA PUEBLO

Rain is a fugitive blessing in the Southwest, but, by terracing the slopes of the mesas and surrounding each small garden inclosure with low ridges of earth, the flood waters that roar down from the mesa tops following torrential midsummer showers are caught and held. By this system of inundation moisture is concentrated in the cultivated areas and gardening is made possible (see text, page 233).

the presumptuousness to erect a puny brace of sticks and stones to hold back 100,000 tons of solid rock that threatened to topple upon their dwellings (page 235).

It is this last colossal conceit—this most naïve feat of ancient American engineering—that gives Pueblo Bonito the name by which it is known throughout the entire Navajo reservation, *Tse-biya hani ahi*—Place-of-the-braced-up-cliff.

During the long period of time in which their invited guests dominated both the religious and secular life of the community, the original settlers of Pueblo Bonito continued quietly to occupy their corner of the village, pursuing their usual activities in the manner to which they had grown accustomed.

The latter were influenced, but to a slight degree only, by the more dominant culture about them. They had the visible example of superior masonry and profited by it when repairing the walls of their dwellings. They drew new elements into

the ornamentation of earthenware vessels, yet kept their characteristic pottery forms and decorative motives.

These pioneer Bonitians maintained rectangular rather than circular kivas, yet they gradually introduced into their council chambers certain special features and furnishings more typical of the round rooms of their neighbors.

Such evidence of cultural influence is quite what one would expect under the circumstances; but it is far less easy to understand why this weakened group of original settlers should wish to remain in Pueblo Bonito after their more numerous and aggressive associates had departed. Theirs was a sinking ship, but they chose to remain with her.

MYSTERY STILL CLOAKS CAUSE FOR ABANDONMENT OF PUEBLO BONITO

As to the fundamental reason and the manner in which Pueblo Bonito was ultimately abandoned, we cannot be sure.

There may have been a single outpouring, a general exodus, like the Children of Israel's, or there may have been a piecemeal migration, a clan or two at a time. Disease may have cut its sudden swath, leaving terrifying thoughts in the minds of these primitive desert dwellers.

There may have been one cause or several. Of this much only are we certain: The Bonitians were being subjected to a constantly increasing pressure from nomadic, enemy peoples. We know that, seeking protection from these demoralizing attacks, the inhabitants sealed all outside doors and windows, thus making of their great community house a veritable fortress. The anxieties of defensive warfare may well have hastened the actual abandonment of the village.

Again, such warfare may have exterminated or reduced to captivity those few survivors of the original settlement who clung tenaciously to their ancestral home.

DWINDLING WATER SUPPLY MAY HAVE CAUSED MIGRATION

Evidence relating specifically to this last period of occupancy is meager and inconclusive. Perhaps the disturbed room burials uncovered last season represent hasty interment of bodies sacrificed in these final struggles. At least one of the defenders was shot through with an arrow; its flint point had been broken off in one of his lumbar vertebrae when the feathered shaft was pulled from the fatal wound.

Other possibilities remain. The water supply may have dwindled; there may have been successive years of drought, during which new crops were not matured; or, what is equally plausible, long-continued irrigation may have produced sterility in their cultivated fields. This latter, indeed, appears to have been a very important contributory factor.

Recent experiments in semi-desert areas of the Southwest show that irrigation water of a certain type tends to eliminate or wash out helpful chemicals from the soil, leaving behind too high a percentage of sodium bicarbonate. The latter has a hardening effect upon the soil and makes it impermeable to water.

During the course of The Society's explorations in Chaco Canyon, we have no-

ticed repeatedly that shallow puddles of rain water sometimes stand for days without wetting the earth so much as an inch below the surface. By analysis of the soil in such places, it has been determined that black alkali is present to such an extent as to render agriculture practically impossible.

Since these salts are found to a depth of ten feet, it is highly probable that farming eventually became as hopeless in ancient times as it would be to-day.

Bonitian gardens were very likely located along the sandy margins of Chaco Canyon to profit most from such rain water as drained off the mesas; but if this water gradually destroyed the productivity of the soil, as it has elsewhere, even a small resident population would soon have found themselves in a very precarious position, threatened with failure of their chief means of livelihood.

In this connection it should be remembered that Pueblo Bonito, at the height of its influence, sheltered no less than 1,200 people, almost wholly dependent upon agriculture. These villagers had no beasts of burden; with prowling enemies present they would not long have sought to cultivate distant farms or to support themselves through barter with other tribes.

THE LAST CHAPTER OF BONITIAN STORY IS LOST IN SHIFTING SANDS

In striving to reconstruct the history of a primitive people who vanished a thousand years ago without leaving any written record of themselves, one is forced repeatedly to call upon the imagination. No matter how much data may be recovered or how accurately they may be interpreted, the story is almost certain to be otherwise incomplete.

Trained eyes may read the secrets of broken pottery and fragmentary implements; experienced hands may piece together scattered bits of information until the significance of the whole is apparent; but when immeasurable gaps occur, it may or may not be possible to bridge them.

Through The Society's explorations the daily life of the prehistoric Bonitians has been at least partially reconstructed, but the impellent forces that hastened the abandonment of Pueblo Bonito and the



Photograph by O. C. Havens

GRADING AND DRYING CORN IN THE HOPI VILLAGE OF ORAIBI

Corn is the principal crop of the Hopi, as it undoubtedly was of the Bonitian. After the harvest, the ripened ears are neatly arranged in stacks, like so much firewood, in the storerooms at the back of the living quarters, until needed for meal.

destination of its builders after leaving their canyon home are problems which still await solution.

On these points no light has yet been shed. This last chapter of their fascinating story is apparently lost—lost in the shifting desert sands of the last thousand years.

Pueblo Bonito stands to-day a fitting memorial to its unknown and long-forgotten inhabitants. It stands a monument

to their primitive genius, to their tenacity of purpose, to their ambition to erect a communal home in which each resident should find a deep and permanent interest. Theirs was an experiment in democracy—an experiment which ripened into full bloom and then withered—a full half millennium before our Pilgrim Fathers dared a similar venture on the bleak coasts of New England.



EXPLORING IN THE CANYON OF DEATH

Remains of a People Who Dwelt in Our Southwest at Least 4,000 Years Ago Are Revealed

BY EARL H. MORRIS

A RUGGED gorge winds westward from the pine-clad slopes of the Chuska Range to lose itself in the multicolored wilderness of northeastern Arizona. Throughout the 25 miles of its length the mottled black-red walls rise, sheer or ragged, 500 to 1,000 feet above the tortuous ribbon of comparatively level land which forms the canyon floor.

The fingers of countless ages have caressed the cliffs and molded them into forms sublimely beautiful. Here, pillar-like, phantasmal colossi support a proportionate architrave; there, in massive stateliness, a mosque stands clear against the sky, while in the distance a detached pinnacle towers to a height of perhaps 1,000 feet, its lines light and graceful as those of the wing of a bird poised for flight.

A SLAUGHTER OF THE HELPLESS

Such is Cañon del Muerto, the Canyon of Death (see Color Plate VIII) and in the origin of the name there lies a story.

"In times past," as an Indian told me across the embers of our campfire, "the Navajo and the Mexicans were great enemies." Until, and even after, the occupation of the Southwestern Territories by the United States, they raided back and forth at every opportunity, each in constant dread of the other.

In the winter of 1804-05, as nearly as the year can be determined, the fighting men of a band of Navajo placed their women, children, and aged in a cave high in the rim rock, where they could not be seen by wayfarers in the canyon below, and rode away to follow their profession.

Before their return a party of Spanish soldiers, for Mexico was still a colony of Spain, marched down the canyon seeking vengeance. They were well past the cave when from the ledge an old woman, who in her girlhood had been a captive among the Mexicans, taunted them in their own tongue as men who walked without eyes. Thus advised of the hiding place, they

encamped beneath it, cutting off all escape, and sent a detachment, by a long and circuitous route, to the mesa top.

Riflemen crept out on a jutting promontory, whence there was a view of the cave, and opened fire on the defenseless occupants. Many fell before the first volleys, and the remainder crept behind and between the blocks of stone which form a natural rampart along the brink of the ledge. Then the riflemen directed their fire against the sloping wall of the cave, depending upon an occasional deflected bullet to find its mark.

When the marksmen judged their end accomplished, they signaled to the watchers below. The latter climbed to the cave, crushed the skulls of the wounded with their gun butts, christened the gorge the Canyon of Death, to commemorate their "victory," and retreated into the night of time.

Because of a superstitious fear of the dead, since that day no Navajo has set foot upon the spot where nearly 100 of his tribesmen met their ignominious fate.

Although in recent years despoiled by white men, the cave still bears mute evidence of the tragedy—hundreds of white marks where bullets splashed against the cliff, bleached bones, and parts of ligament-bound skeletons lying in general disorder in the dust (see illustration, page 265).

WRESTING SECRETS FROM THE DEAD

This was only an episode in the history of Cañon del Muerto, a history written not in formal documents, but in the results of their occupation, left in the caves by the succession of peoples who for unnumbered centuries dwelt within.

Food substances, articles of dress, implements and weapons, domestic utensils, types of dwellings, and burial customs are the alphabet in which the story of people who knew not the art of writing is recorded; and these symbols the technique



Photograph by O. C. Havens

DRYING PEACHES IN THE HOPI VILLAGE OF ORAIBI: NORTHEASTERN ARIZONA

of the archeologist translates into the history of primitive culture.

During the fall of 1923 I began the study of the prehistoric ruins in Cañon del Muerto for the American Museum of Natural History of New York City. On a bright September day our expedition encamped in front of Mummy Cave. In the latter there stands a typical cliff dwelling, a masonry structure of 80 rooms, in one place three stories in height (see pages 270 and 271).

From the front of the building a blanket of refuse, principally ashes and sweepings, spreads down over the sloping rock to the top of the natural talus, 100 feet below.

At one end of the refuse deposit the wind had uncovered human bones, and

there we began to dig. The first skeletons were badly decayed, and the only objects found with them were stone pipes.

Farther in, beneath a covering of cedar bark, there lay the body of a man mummified by desiccation. Buckskin moccasins with an insole of cedar bark inclosed the feet, and spiral leggings of the same material extended to the knees. A broad sash of buckskin encircled the waist three times. One end fell like an apron to the middle of the thighs, while the other was tossed diagonally across the breast and over the left shoulder.

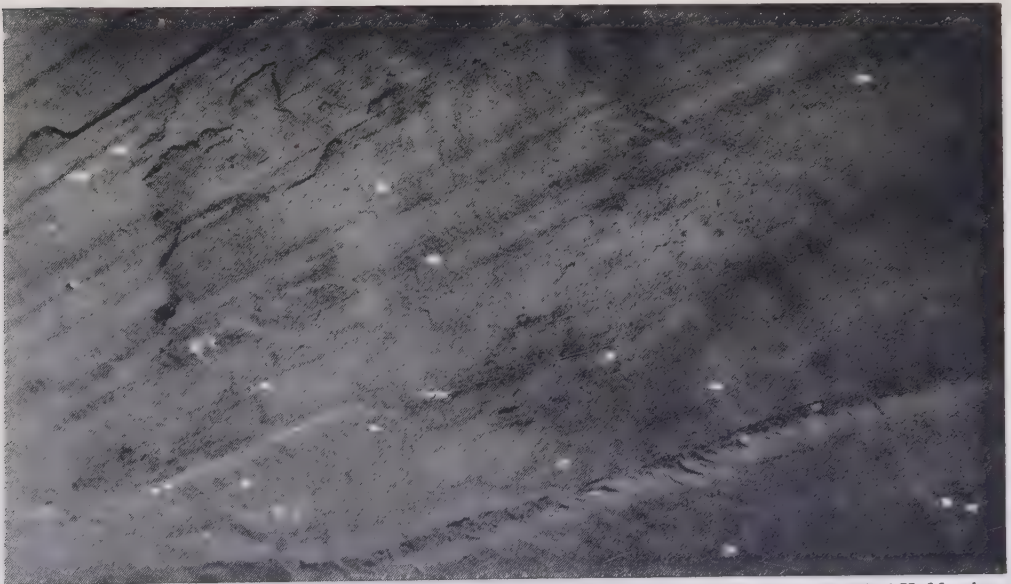
On the left wrist was a bracelet of shell beads, and by the right side a spear thrower. On the breast lay a wooden flageolet incrustated with white beads set in pitch, a sack made from the entire skin



Photograph by Edwin L. Wisherd

THE NATIONAL GEOGRAPHIC SOCIETY'S WAGON IN CAÑON DEL MUERTO

In connection with its work in the Chaco Canyon region, The Society sent a photographic party into the canyons of northeastern Arizona.



Photograph by Earl H. Morris

BULLET MARKS IN MASSACRE CAVE

When the Navajo who had not fallen before the first volleys crawled between and behind the blocks of stone which line the front of the cave, riflemen on the ledge high above them began shooting against the rear wall, depending upon deflected bullets to complete the work of extermination (see text, page 263). Although more than a century has passed since the Spaniards splashed their lead against the cliff, the marks are as white and fresh as if made but yesterday.



Photograph by Edwin L. Wisherd

LOOKING DOWN CAÑON DEL MUERTO FROM MUMMY CAVE

In this cave are the remains of a large cliff dwelling (see pages 268 and 269) which yielded many articles of dress, implements, and domestic utensils—"symbols which the archeologist translates into the history of primitive culture."



Photograph by Edwin L. Wislerd

A NAVAJO WOMAN DRYING PEACHES: CAÑON DEL MUERTO

Because of a superstitious fear of the dead, neither this woman nor any of her tribe has ever set foot in the cave in this canyon, where nearly 100 of her people were shot down more than a century ago (see text, page 263).



Photograph by Edwin L. Wisher

A PREHISTORIC CLIFF VILLAGE IN MUMMY CAVE (SEE, ALSO, OPPOSITE PAGE.)



Photograph by Edwin L. Wisherd

A DETAILED VIEW OF THE PREHISTORIC CLIFF VILLAGE IN MUMMY CAVE (SEE, ALSO, PRECEDING PAGE)



Photograph by Edwin L. Wisherd

A THREE-STORY CLIFF DWELLING IN MUMMY CAVE
(SEE TEXT, PAGE 264)

of a small animal, containing a pipe and smoking materials, and a number of bone implements.

A basket lay beneath the head, another was inverted over it, and a blanket made of cords wrapped with strips of rabbit skin enveloped the entire frame. Evidently, when animate, the shrunken body had been that of an important personage in the ancient community.

EARS OF CORN THOUSANDS OF YEARS OLD

As we trenched upward, following the rock, which sloped at an angle of 45 degrees, we cut through various cribbings of stones, logs, and brush built as retaining walls to hold back the refuse and thus

increase the area of the cave floor.

Eventually we came to a large series of storage bins. These were rude inclosures of irregular form from two to six feet in diameter and of varying depth. Large, thin slabs of stone set on edge composed the walls, the joints of which were sealed with mud made tough with shredded bark, reed leaves, or corn-husks. The roofs of only two were in place.

Resting upon the tops of the slabs in each case was a jug-like neck of adobe reinforced with sticks. The covers were slabs of stone worked down to nearly circular form. In one of the storage cysts there were 700 ears of corn, which, although thousands of years old, were as bright and fresh as if recently gathered.

In another there was a heap of slender gourds of the kind from which bottles

and dippers were made, and in a third a quantity of seeds of a variety which the Navajo still grind as a substitute for flour.

As the rubbish resulting from occupation accumulated in the cave, the cysts farthest down the slope were allowed to become filled with it, and contained, naturally enough, many discarded objects. In such places we found hundreds of cloth sandals, many of them handsomely ornamented both in colors and raised weaving; baskets, arrows, knives, agricultural implements, and a variety of minor objects too numerous for individual mention.

In the center of each cluster of storage cysts there was a dwelling chamber, a rudely circular structure 12 to 25 feet in



Photograph by Edwin L. Wisherd

TWO-STORY CLIFF HOUSE IN MUMMY CAVE

From the front of the dwelling, a masonry structure of 80 rooms, a blanket of refuse spreads down over the sloping rock for a distance of 100 feet (see text, page 264).



Photograph by Earl H. Morris

A CAVE SANCTUARY

Often the inhabitants of the caves disturbed and destroyed the graves and dwellings of their predecessors. Here, in the construction of a masonry kiva, a ceremonial chamber, the cliff dwellers dug down through a previously existent slab house. The part of the latter which was not demolished they made use of as an enlargement of the underground room.

diameter. The walls had been of posts set leaning inward, and plastered over with mud, and the roofs of logs covered with earth. Fire—perhaps accidental, perhaps incendiary—had destroyed one of these rooms and with it the possessions of its occupants.

On the smooth earth floor surrounding the sunken fireplace were several pottery vessels, and elsewhere lay charred baskets, sandals, planting sticks, and practically every sort of article manufactured by the inhabitants.

Beneath the masonry cliff dwelling three culture levels were recognizable (see text, page 300).

A MAGNIFICENT MOSAIC ORNAMENT
FOUND ON BREAST OF A MUMMY

Around the corner of the cliff from Mummy Cave was a cemetery. Bones lying about the mouth of an animal's burrow gave the clew, and we set to work with the expectation of rich finds. The bubble of our hopes, however, was soon

punctured, for destruction had preceded us. A deep recess had been packed full of bodies of all ages, accompanied by quantities of burial offerings, enough of them at least to transform the spot into a charnel place, when fire of unknown origin gained access to the grotto.

For days we worked through an 18-inch layer of calcined bones smoked black or burned an ashy white and more brittle than icicles. There must have been more than 100 bodies in the original heap.

The meager fragments of specimens recovered from the wreckage poorly repaid our efforts, but the unexpected, which always holds a beckoning finger before the archeologist, brought us our reward in the end.

In front of the burned area a pit had been dug in the talus and three bodies placed in it. They lay back downward, one on top of the other. As I was removing the earth from the breast of the second, there were glints of blue in the mold upon my trowel.

A few strokes with a brush laid bare a magnificent mosaic ornament which had been worn around the neck. It was a large, skillfully fashioned ring of hard wood solidly incrustated with turquoise set in gum, each piece highly polished and accurately shaped to the space it was to occupy (see illustration to right).

A mouse had dug its burrow past the pendant and in so doing had detached a few of the stones. These were recovered by passing the adjacent earth through a fine screen.

Altogether apart from its intrinsic beauty, this pendant was the most ancient piece of mosaic work thus far discovered in the Southwest; hence the little group of excavators gloated over it as if it had been a king's ransom.

A few moments later we stared at each other in blank astonishment, for on the breast of the third skeleton there lay a second pendant precisely like the first, except that there was included among the mosaic elements a large rectangle of iridescent abalone shell.

A CAVE DISCOVERED HIGH UP IN CANYON WALL

While we were still at work on the "boneyard," as we called the charnel place, my wife reported the existence of an obscure cave in a side canyon not far from camp. With the binoculars a line of mountain sheep and human figures, painted in white on the rear wall, could



Photograph courtesy American Museum of Natural History

A TURQUOISE MOSAIC PENDANT

This breast ornament, $3\frac{1}{4}$ inches in diameter, made of turquoise set on wood with gum, is the most ancient mosaic thus far found in the Southwest. It was preserved in recoverable condition as if by a miracle, for the skeleton with which it was found was so badly decayed that the bones could be rubbed to powder between the thumb and forefinger.

be discerned, proving that the cave had been occupied (see page 292).

A half hour's climb brought us directly beneath it, but face to face with a ledge 30 feet in height, worn smooth by the sandstorms of ages. The aborigines had pecked foot-holes in the rock, but these were so badly weathered that they were no longer of any use.

The one of us deemed of least account in mundane affairs was called upon to make the ascent. This he did, lying flat against the rock, working himself for-

ward inch by inch with his hands, and depending upon friction to keep him from slipping. Once on top, he tied a rope to the butt of a stunted tree, and, with this to hold to, the others clambered up without difficulty.

A moment later we were in the cave, looking out upon a scene never before beheld by human eyes; never before, because ledges had crashed down and generations of trees had grown and rotted since the last of the ancients departed.

CHILDREN'S BODIES PACKED LIKE SARDINES IN A GRAVE

Turns in the canyon cut off the view to the left and right, with the effect that below us lay a vast pit, its slopes cluttered with jagged blocks of stone and dotted here and there with gnarled cedar trees. At the very bottom, along the drainage course, there was a crooked line of very large spruces, so distant that they seemed like parlor Christmas trees. Smaller conifers fringed the rim rock opposite us, and above its towering red expanse there showed a ribbon of clear blue sky (see page 293).

There were a few intact rooms at one end of the cave, fallen masonry covering most of its area, and retaining walls, bastionlike, at the front of it. Where two of these met at a sharp angle, a pair of mummified feet protruded from the debris.

The tightly folded body was wrapped in a feather-cloth blanket. Three slender poles lay lengthwise above it and three shorter ones in the opposite direction. Upon these was spread a mat made of reed stems, which in turn was covered by one of neatly plaited rushes.

On the left wrist there was a bead bracelet composed of lignite disks one-twenty-fifth of an inch in diameter, and at the right of the head were a pottery bowl and drinking vessel. In a niche at the back of the cave were two handsome vessels—a large one, a dull-white, flat-topped vase, with vivid black decoration; the other a red, spherical canteen provided with two loop handles, and a bail braided from strands of human hair.

Some matron in the old days had filled these vessels with dried sunflower petals and hidden them away against the fu-

ture—a future which for her never dawned.

The largest cave in Cañon del Muerto was three miles below our camp. It was a blustery morning late in October when we set out, each with a backload of tools, cameras, and what not, to begin work there.

On the way we were not permitted to forget a baconless breakfast, for every now and then our own footprints blotted out those of the bear that during the previous night had devoured our last slab of meat which had been left hanging from the limb of a tree just outside the tent door. Once within the great cave, however, so minor a point soon passed from mind.

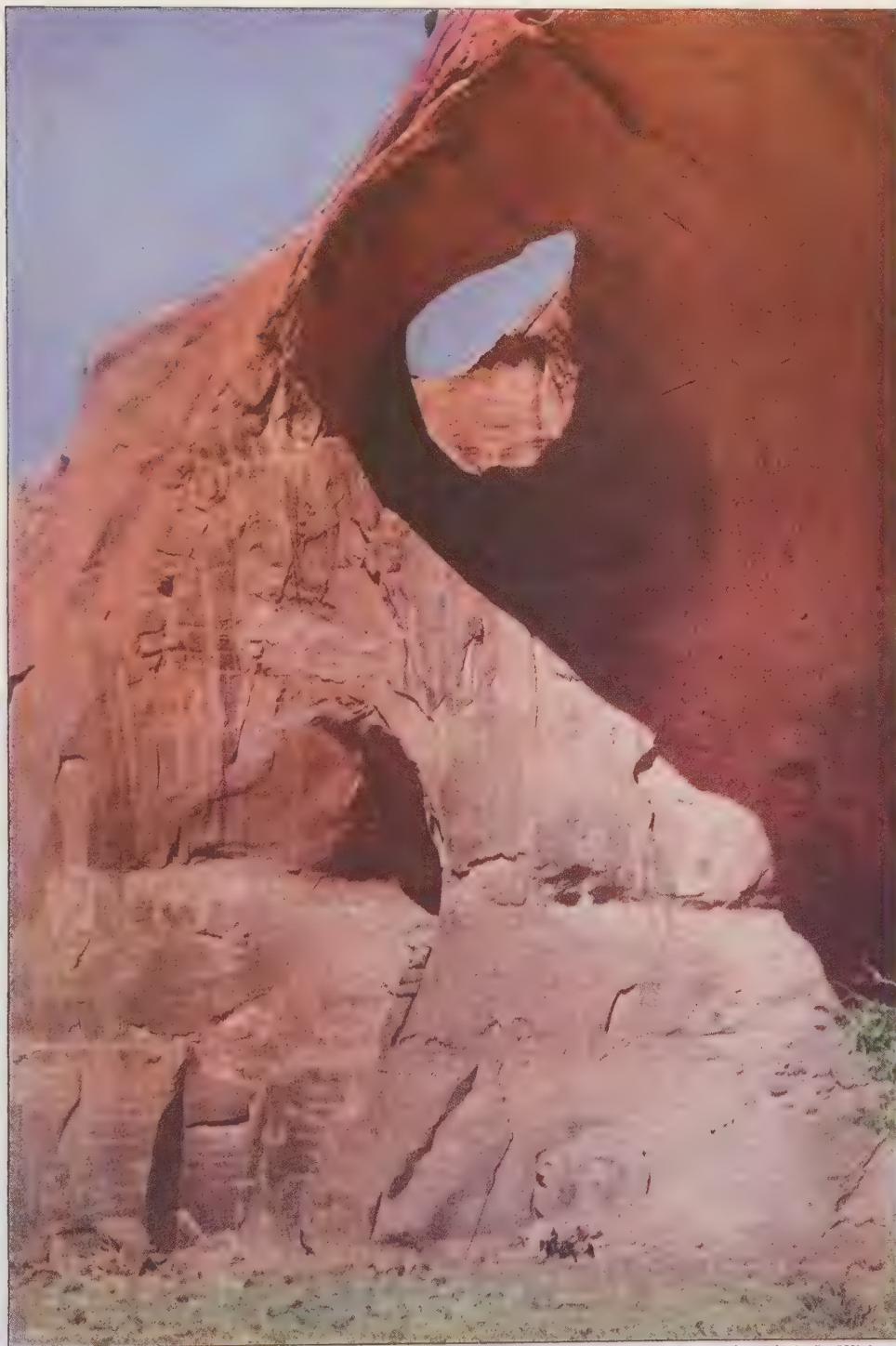
Near the western end of the 1,100-foot shelter the corner of a slab cyst like those in Mummy Cave was visible in the bank of a pit opened by some relic-hunter.

I thrust my shovel into the debris which filled it, and when I raised the blade there was the skull of a child upon it. The cyst was triangular, the sides being three feet in length and the base three and a half feet. It appeared to have been completely filled with the bodies of infants and small children. Each one was wrapped in a padlike mass of soft fiber made from leaves of the yucca plant and shrouded either in a fur or feather-cloth blanket. They were packed in as tightly as sardines in a tin.

After I had removed the 14th, my fingers touched a corrugated surface which at first I thought to be the ribs of a shrunk body. When the dust was brushed away it proved to be the side of a basket so large that had it been two inches greater in diameter it could not have been placed in the cyst. Inside it were the skeletons of four more children, two of them with bracelets on the left wrist, each a strand of white beads interspersed with pendants of abalone shell.

AN ANCIENT GRAVE ROBBER LEAVES A CLEW

The neighboring areas were literally full of graves. In several the bodies were so well preserved that the features appeared as lifelike as those of the mummies of the Pharaohs. When we lifted the one shown in the accompanying illustration



Natural Color Photograph by Edwin L. Wisherd

©

IN THE LAND OF THE NAVAJO

The red canyon walls of northern Arizona hurl back amplified echoes of the shouts of Indian horsemen.
Note the two mounted men at the base of the cliff.

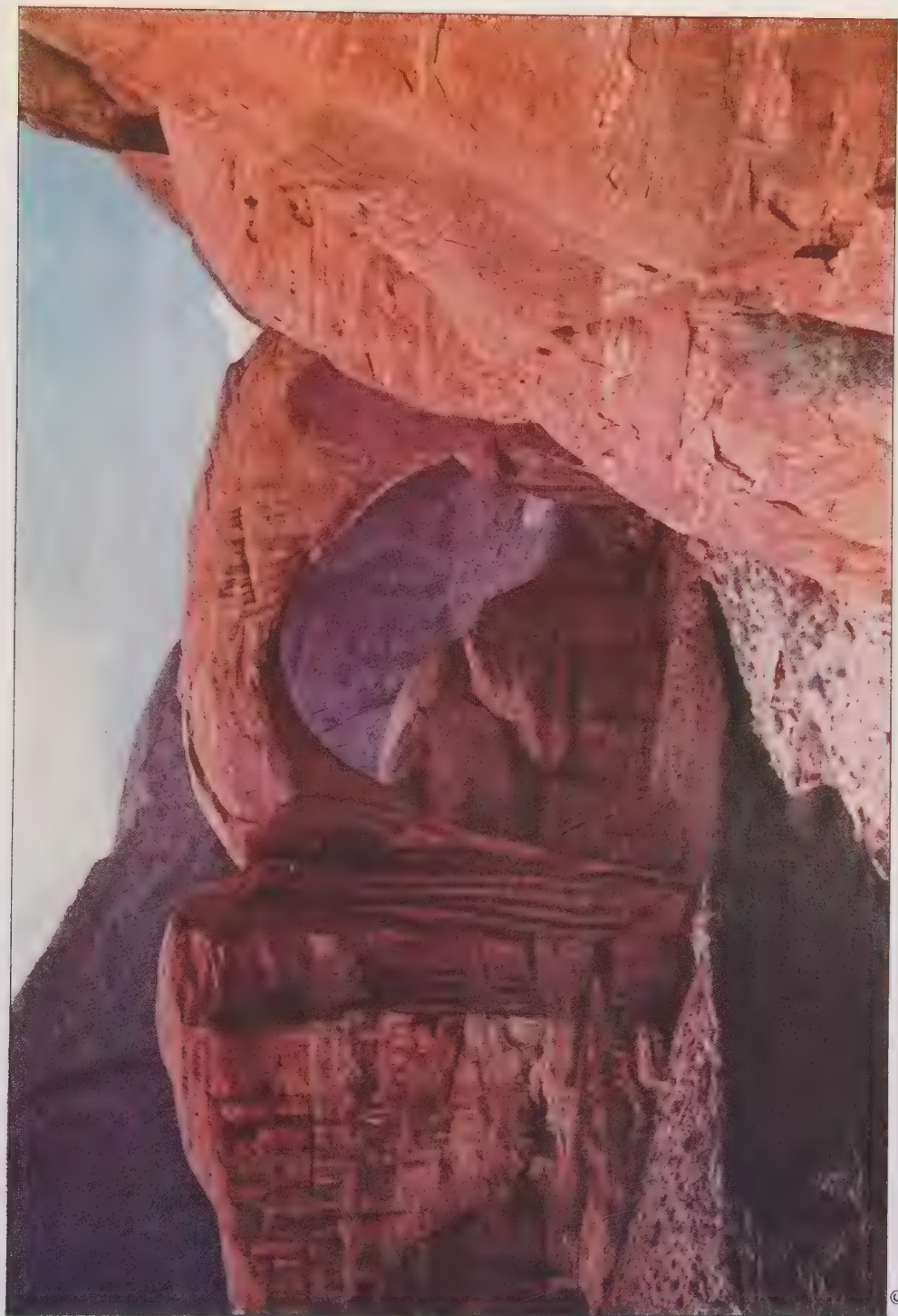


©

Natural Color Photograph by Edwin L. Wisherd

PLAYGROUND OF THE DESERT GODS

Stretching for miles along the Utah-Arizona border northwest of Cañon del Muerto, sunlit Monument Valley becomes a veritable kaleidoscope, as fleeting clouds paint its red buttes purple and blend its far horizon with a turquoise sky.

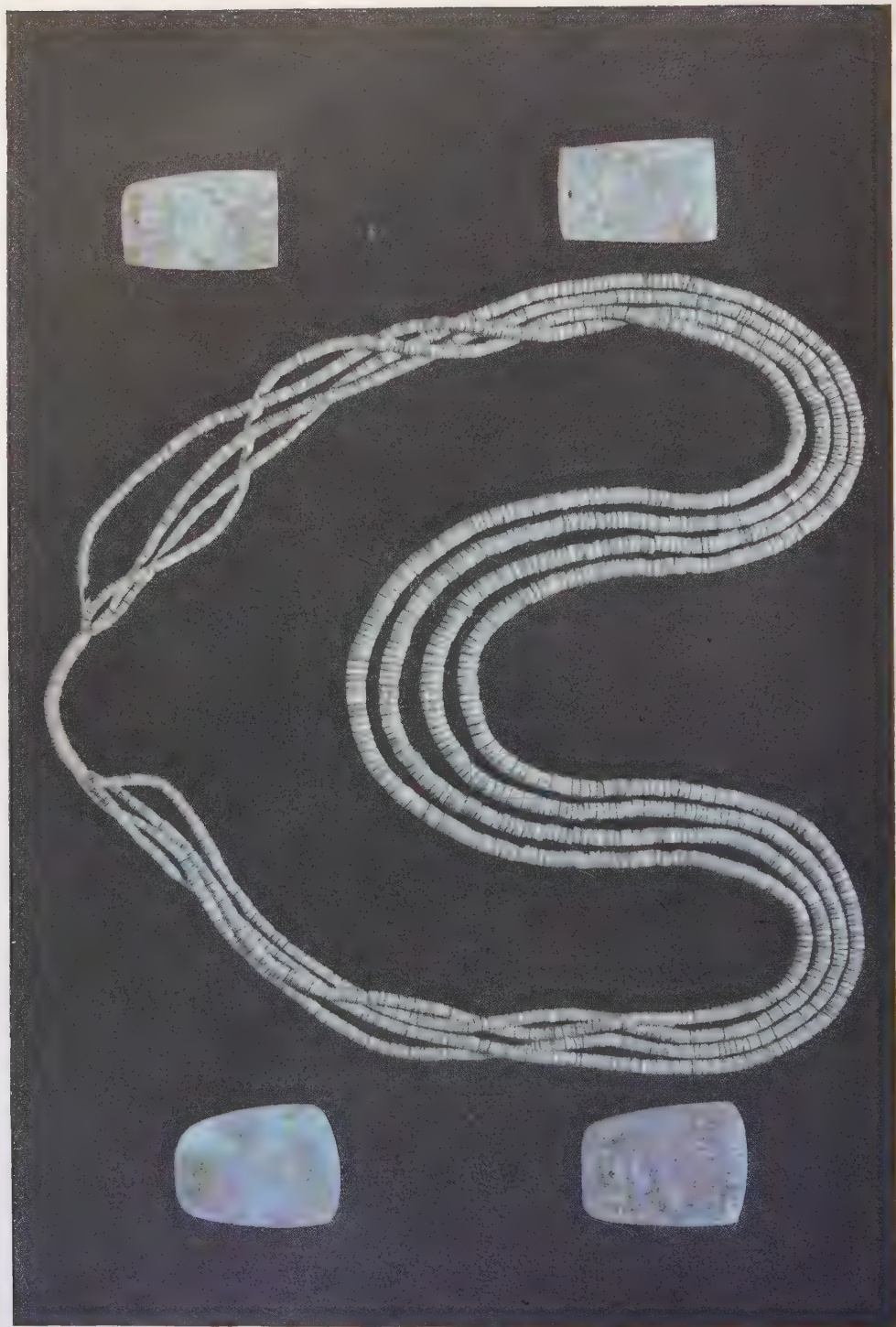


©

THE RAINBOW ARCH, LARGEST OF THE WORLD'S NATURAL BRIDGES

Natural Color Photograph by Edwin L. Wisherd

It was Professor Byron Cummings, now leader of the National Geographic Society Cuicuilco, Mexico, Expedition, who in 1909 led his party of young explorers across the desert trails of northern Arizona, around the rocky slopes of Navajo Mountain to the discovery of Rainbow Bridge, one of the most marvelous and awe-inspiring works of Nature to be found in North America (see the National Geographic Magazine for February, 1910, and February, 1923).



©

TURQUOISE NECKLACE AND EAR PENDANTS FROM PUEBLO BONITO

Natural Color Photograph by Charles Martin

These incomparable ornaments were the pride and joy of an Indian who lived in Pueblo Bonito a full thousand years ago. They were discovered, buried under 15 feet of sand and debris, by a National Geographic Society Expedition in 1921; they form the only complete set of their kind known in the museums of the world to-day (see "Everyday Life in Pueblo Bonito" in this number of the National Geographic Magazine).



©

PUEBLO BONITO, NEW MEXICO, IN SEPTEMBER, 1923

Natural Color Photograph by Edwin L. Wisherd

When the National Geographic Society began its exploration of this prehistoric Indian village in 1921, it presented much the same appearance as that unexcavated portion at the extreme right. The entire ruin has now been laid bare and a new chapter added to the history of America prior to the Spanish conquest.



©

Natural Color Photograph by Edwin L. Wisher

ROCK FINGERS POINTING TO THE GLORY OF ARIZONA SKIES

The borders of Monument Valley are marked by colossal buttes and red sandstone pinnacles that tower 800 feet above the shifting desert sand.



©

Natural Color Photograph by Edwin L. Wisherd

ON THE TRAIL TO RAINBOW NATURAL BRIDGE

From Kayenta, Arizona, the Rainbow Bridge trail leads through silent canyons in whose sheer red walls rounded caves furnished village sites for prehistoric Cliff Dwellers.



©

Natural Color Photograph by Edwin L. Wisherd

CAÑON DEL MUERTO

The Canyon of Death was so named after Mexican villagers had surrounded and killed a large number of Navajo, in retaliation for repeated Indian raids against settlements far to the south (see article in this number of the National Geographic Magazine). Note the man in the middle distance.



©

BEAUTY IN A WEARY LAND

This small, cylindrical, densely spiny cactus (*Coryphantha nemoralis*) adorns the sparsely covered rocky slopes of the foothills of the Guadalupe Mountains near Carlsbad Cavern, New Mexico. It is inconspicuous except in blossom time, when its brilliant flowers, massed thickly at the top of the somber-colored plant, vary the dull monotony of the brown landscape.



Natural Color Photographs by Jacob Gayet

A MELON IN BLOOM

This small, grayish-green, globular cactus (*Echinocactus horizonthalonius*) is a familiar sight on the plains near the Guadalupe foothills. Its brilliant blossoms are massed at the top, forming a crown of glory. The fruit, little less conspicuous than the flower, consists of large oblong berries which turn crimson or vermillion as they ripen.



©

Natural Color Photographs by Jacob Gayer

BANNERS OF THE DESERT

The strawberry cactus (*Echinocereus stramineus*), showing a small cluster of heads in the lower illustration and a nearer view above. The common name is suggested by the delicious brownish-red berries, crisp and juicy, which taste like strawberries. The green, spiny heads, hundreds in number in favorable places, are closely massed, forming great oval clusters three or four feet in diameter. The heads are covered thickly with long slender spines, and from the side spring the brilliant flowers. These plants thrive on limestone ledges and in blossom time they cause canyon walls to blaze with color. The blooms are sensitive to light; they reach the height of their glory in the morning sunlight, close toward evening, and "sleep" at night.

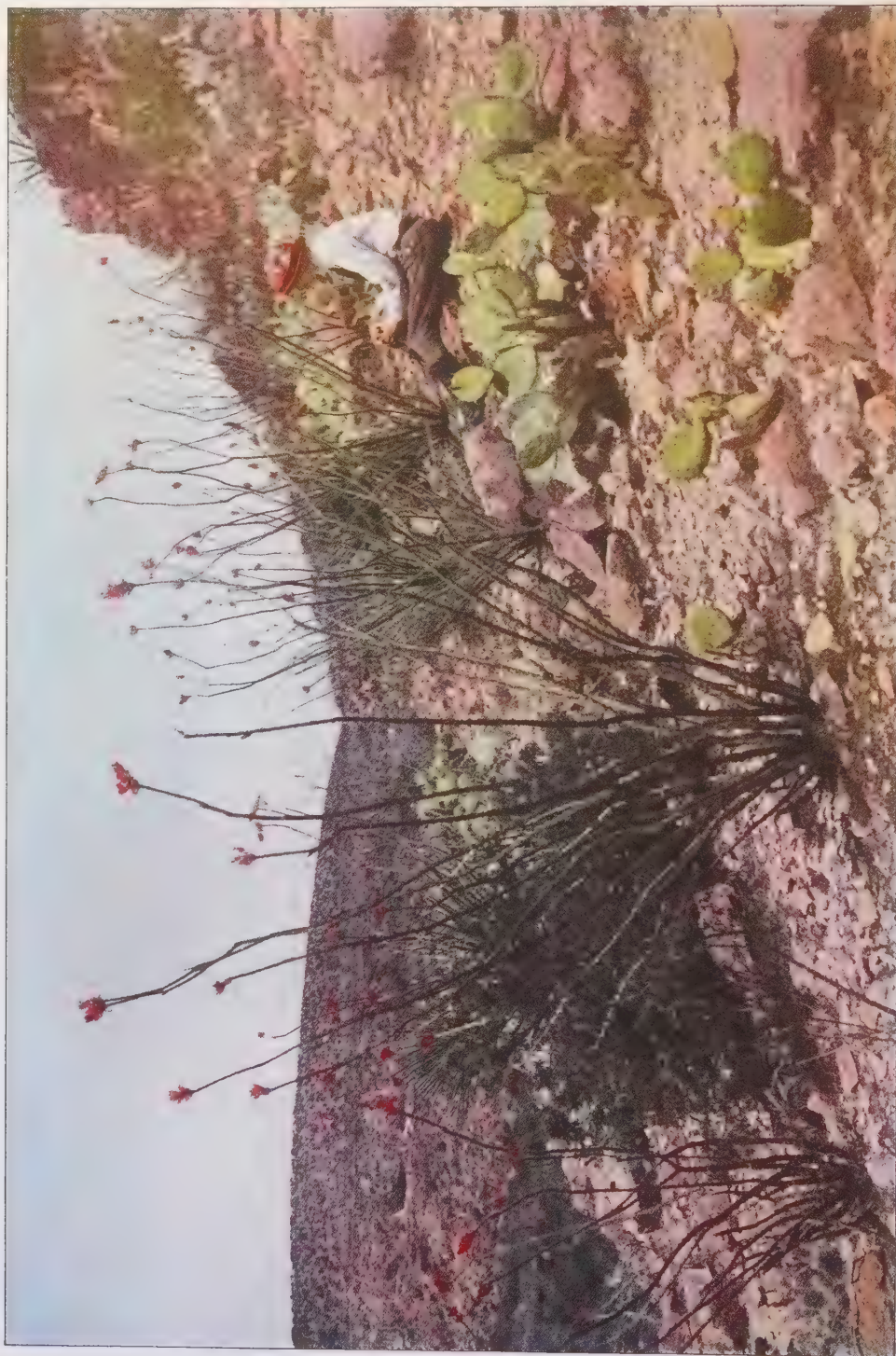


©

Natural Color Photographs by Jacob Gayer

THE ORCHID'S RIVALS

Above is a prickly pear (*Opuntia engelmannii*), which thrives in the sheltered nooks of the canyons of the Southwest. The plants, sometimes three or four feet high, grow in thickets. Many of the great fleshy pear-shape joints are solidly decorated along the edge with showy flowers, in the illustration reduced to about one-third the natural size. The fruit is conspicuous. When ripe the dark-red berries, two to four inches long, have crisp flesh of delicious flavor. The juice is used as a coloring fluid. The prickly pear below (*Opuntia tenuispina*) forms dense mats of spiny, interlacing branches which in early summer, after a shower, become flower beds of varied and delicate hue.



©

IN A SOUTHWEST DESERT FLOWER GARDEN

Natural Color Photograph by Jacob Gayer

The limestone hills near Carlsbad Cavern, New Mexico, are sparsely covered with green prickly pears, sotols, ocotillo or candlewood, and other species of desert plants. The ocotillos branch at the base into long furrowed, spiny stems. In early summer the tip of each stem bears a showy cluster of blossoms—the candle's flame (see Color Plates on opposite page). Later the green leaves appear and partly cover the ribbed, spiny poles.



©



Natural Color Photographs by Jacob Gayer

THE CANDLE'S FLAME

The showy top of an ocotillo stem (*Fouquieria splendens*) in full bloom is shown at the left, and a detail of the same plant at the right. The plant is also called candlewood, coach whip, and Jacob's staff.



"MIGHTY L'AK A ROSE"

An early-blooming strawberry cactus (*Echinocereus paucispinus*) with deep-green fleshy head, few ribs, and few spines. Unlike the strawberry cactus shown on Plate X, its blossoms, which appear early in the spring, remain open at night. When the fruit is fully ripe, its spines are readily brushed off, leaving a juicy, palatable berry.



©

Natural Color Photographs by Jacob Gayer

POSING UNDER DIFFICULTIES

This budding cowboy of stoical mien, lying beside a strawberry cactus, will have many an unpleasant encounter with cacti in years to come as he "punches" cattle over hill and plain.



A DESERT BEAUTY NEAR CARLSBAD CAVERN

This little prickly pear (*Opuntia poltsii*) consists chiefly of spines and gorgeous blooms. This specimen was found on the gypsum flat where desert conditions are at their worst. The joints are small and "lean," as if the plant were starved, and are covered with needlelike spines, which protect it effectively from the browsers. But when it blooms the desert is glorified.



©

Natural Color Photographs by Jacob Gayer

A RELATIVE OF THE RAINBOW CACTUS

This cactus (*Echinocereus dasyacanthus*) has many ribbed cylinders, about a foot high, which grow singly or in loose clusters, and are densely clothed with bunches of short spines.



©

Natural Color Photograph by Jacob Gayer

THE DOME ROOM IN CARLSBAD CAVERN, NEW MEXICO

This chamber of weird beauty is decorated on all sides with delicately tinted crystalline onyx marble, known also as oriental alabaster. Oriental alabaster, composed of carbonate of lime, should not be confused with alabaster proper, which consists of sulphate of lime. The Cavern, which has been explored by two National Geographic Society Expeditions, has been set aside by Presidential Proclamation as a national monument.

from the grave pit (see page 297), we turned it on its side to permit the dust to sift out of the wrappings.

Amid the dust were two beautiful sets of turquoise, once elements of a mosaic. We searched for the ornament to which they belonged, but found no trace of it.

Months later, while I was preparing the mummy to be photographed for this article, another bit of turquoise was found beneath the chin, and across the breast my brush laid bare the deep impression of the rim of a basket which had been inverted over the head. Farther down, just below the end of the breastbone, there was a depression where a large oval pendant half an inch thick had settled into the flesh.

The story was now as clear as if set in good bold type. Centuries ago some aborigine had partially opened the grave, removed the basket which covered the face, reached beneath the wrappings, and withdrawn the coveted ornament. In so doing he loosened and lost the three turquoises, which remained to convince us that in ancient America, as well as in Egypt, grave robbers plied their trade.

If the Fates continue to be kind, some day they will guide my shovel to the bones of the one who in this case preceded me, for upon his breast the great pendant may still repose.

WOMAN'S MUTILATED MUMMY YIELDS RARE ORNAMENT

A few days' work in this cave so increased the bulk of our collection that two four-horse teams were necessary to freight it out of the reservation and over the 100-mile stretch between our camp and Gallup, New Mexico, the nearest railroad point (see map, page 232).

Throughout the ensuing months the lure of the canyon called imperatively, with the result that October, 1924, saw us again encamped among the sage and cacti.

At the close of a five weeks' campaign the freight teams once more trekked Gallupward laden with a precious cargo.

Many of the finds were fully as spectacular as those of the preceding season. In the grotto which had sheltered the looted burial an old woman had been interred back downward, with knees point-

ing vertically upward, as was the custom.

In the course of subsequent building activities a slab floor had been laid only four inches above the trunk. Necessarily the raised knees had offered an obstacle to its construction. In consequence the builders twisted off the legs and threw them down along the right side of the torso. Doubtless they also removed the baskets and other burial offerings which had been visible above the wrappings.

It was just before midday when I lifted the blanket-swathed trunk from its age-old resting place and laid it, with more disgust than reverence, upon a near-by ledge. Throughout the noon hour my thoughts were filled with sentiments more forceful than polite concerning the vandals who had deprived us of the spoils which I felt certain had been placed with the carefully wrapped remains.

Lunch over, as we waited for the blood to cease pounding in our ears after the climb from the valley floor to the cave, Owens, my helper for nearly a decade, said, "Let's see what is under that blanket."

I raised one edge of it and gave a shout that was occasioned not by pain or disappointment. Encircling the withered left wrist was a cuff five inches wide, composed of 200 perfectly matched *Olivella* shells with a single set of extraordinarily fine turquoise at the center. This time the laugh was on our side, for the robbers had overlooked an unusually handsome ornament and one unique among archeological material from the Southwest (see page 298).

"THE BURIAL OF THE HANDS"

In another portion of the cave we came upon "The Burial of the Hands." On a bed of grass, side by side, with palms uppermost, lay the ligament-bound hands and forearms of an adult. The severed elbows touched the wall of the cyst, thus proving that the burial as it was found was complete, and that the rest of the body had never been included in the interment.

Touching one radius were two pairs of unworn sandals with patterns in black and red, probably the most exquisite specimens of their kind that have survived for the inspection of modern man. Against



Photograph by Earl H. Morris

A MAZE OF ROCK PAINTINGS

The caves of the Canyon of Death are a veritable picture gallery. Upon the smooth rock faces are depicted tens of thousands of snakes, birds, men, and animals, as well as geometric patterns. Many pigments were used—white, yellow, blue, green, red, and black. In age the paintings vary from the red square-shouldered men drawn by the Basket Makers to charcoal drawings done by the present-day Navajo.

the other forearm was a small basket nearly half full of long, crescentic beads of white shell.

Heaped upon the wrists were three neck cords. One bore a single pendant of abalone shell as large as the palm of one's hand, and another two smaller ones of the same colorful, iridescent material. The third breast ornament was a masterpiece. Lashed at short intervals to the neck cord, and overlapping like links of armor, were 18 shell rings, each about three inches in diameter. As worn, they formed a tinkling white collar which reached from shoulder to shoulder.

Covering the entire cluster of treasures was a basket nearly two feet in diameter.

NOTES OF AN ANCIENT FLUTE CONJURE UP SCENE OF SAVAGE POMP

Several explanations of this "Burial of the Hands" could be written, but probably not one of them would come near to the truth of the mystery which lies behind it.

Our last great find was separated from

the hands only by the thickness of an upright slab. Beneath a stone floor there lay nearly a wagonload of cedar bark and grass, crowded into a space six feet by three. The surface of it was bright and fresh, as if it had been deposited but yesterday. However, at a depth of a few inches it changed to a mass thoroughly carbonized, but not reduced to ash.

Since the charring did not extend to the outer limit of the inflammable material in any direction, the fire could not have been set after the burial was completed. Spontaneous combustion seems out of the question; hence it appears not improbable that fire was buried with the dead.

As my fingers reached the offerings with the first body, I cursed the destructive agencies—decay, erosion, burrowing animals, vandals, fire—which so often had conspired to thwart us. A large basket had lain over the head, and on the breast were beads of wood and of yucca seeds, a stone pipe, and many other objects



Photograph by Earl H. Morris

A VIEW DOWN CAÑON DEL MUERTO FROM PICTOGRAPH CAVE

On an autumn afternoon black shadows creep across the valley floor, the streamlet lies like a silver ribbon flowing in the trail of a snake, green cactus patches alternate with yellow fields of corn, the northern cliffs tower flaming red beneath their crown of black-green forest, and the rocks in the foreground, full struck by the waning sun, blaze with ruddy gold.

charred beyond recognition—a taunting mass of ruin.

But again the frown of Fortune ended in a smile. The blackened knees of another body were beside the skull of the first. As we worked downward along the thighs, the burned area became smaller and smaller, and finally ended where the fire had smothered out, just as it reached the trunk.

The body was that of an old man, surely once a priest or chief. Beside the usual offerings of beads, baskets, and sandals, there lay above his buckskin wrappings a flute, one end beneath the chin, the other between the thighs. By the left shoulder was a basket containing an enormous stone pipe and many thick hanks of human hair, each wrapped and tied at the center with a cord.

Along the left side was a mass of wooden objects, all readily perishable, hence extremely rare in perfect condition. Conspicuous among them were bone-tipped flint flakers with which knives and

projectile points were made, several spears, four handsomely wrought spear throwers, and three more flutes.

I picked up one of the flutes, shook the dust and mouse dung out of it, and placed it to my lips. The rich, quavering tones which rewarded even my unskilled touch seemed to electrify the atmosphere. In the distance Navajo workmen paused with shovels poised, seeking the source of the sound. A horse raised its head and neighed from an adjacent hillside and two crows flapped out from a crevice overhead.

Our little group was motionless for a dozen heartbeats, which seemed as many minutes. In the weird silence it was as if time had been halted in its flight—nay, turned back—for in swift array there crowded through my consciousness the scenes of grief and mourning, of savage pomp and ceremonial, amid which the tones of that instrument had last echoed from the selfsame cliff that now glistened under the rays of the setting sun, which



POSING WITH HIS TROPHIES

In jovial mood, Owens, whom the author describes as "the best digger in all the Southwest," dons as a hat a basket which for a few centuries lay over the head of a mummy, and holds before him a sheaf of three huge oaken blades which he found beneath a cliff-house floor.



Photographs by Earl H. Morris

AN EXCAVATOR WEARING A GAS MASK IN MUMMY CAVE

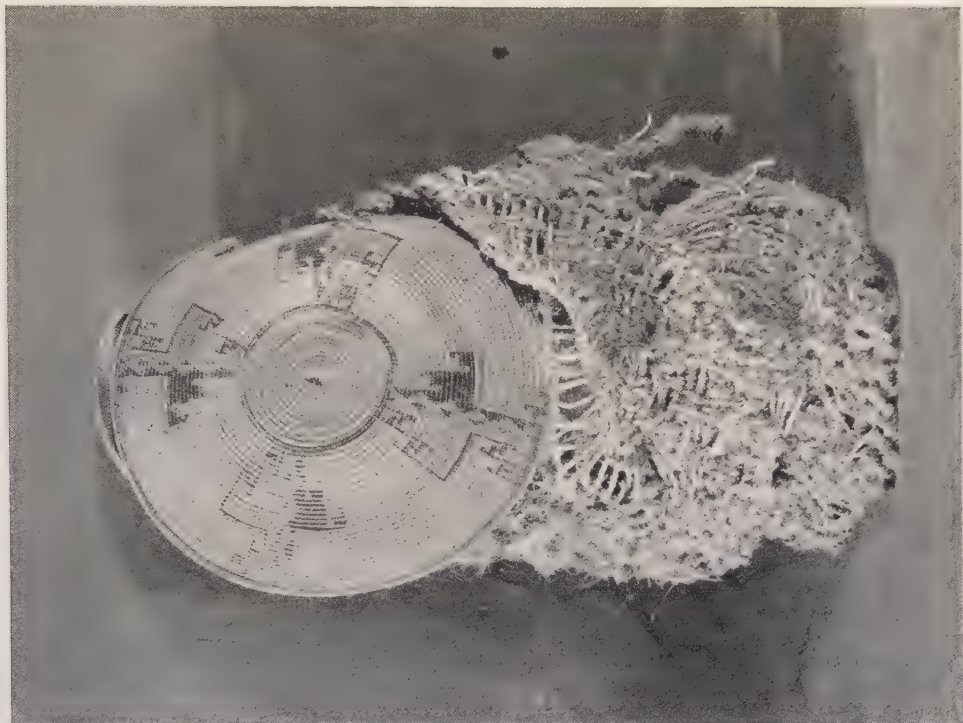
A gray pall always hangs above the pits where the workmen search for treasures of the past. The fine dust, blended of ash and filth and human waste, will exact its toll if not excluded from the lungs. Hence one labors for breath behind a mask of wet cloth or sponges.



Photograph by Earl H. Morris

A BASKET MAKER OF LONG AGO: CAÑON DEL MUERTO

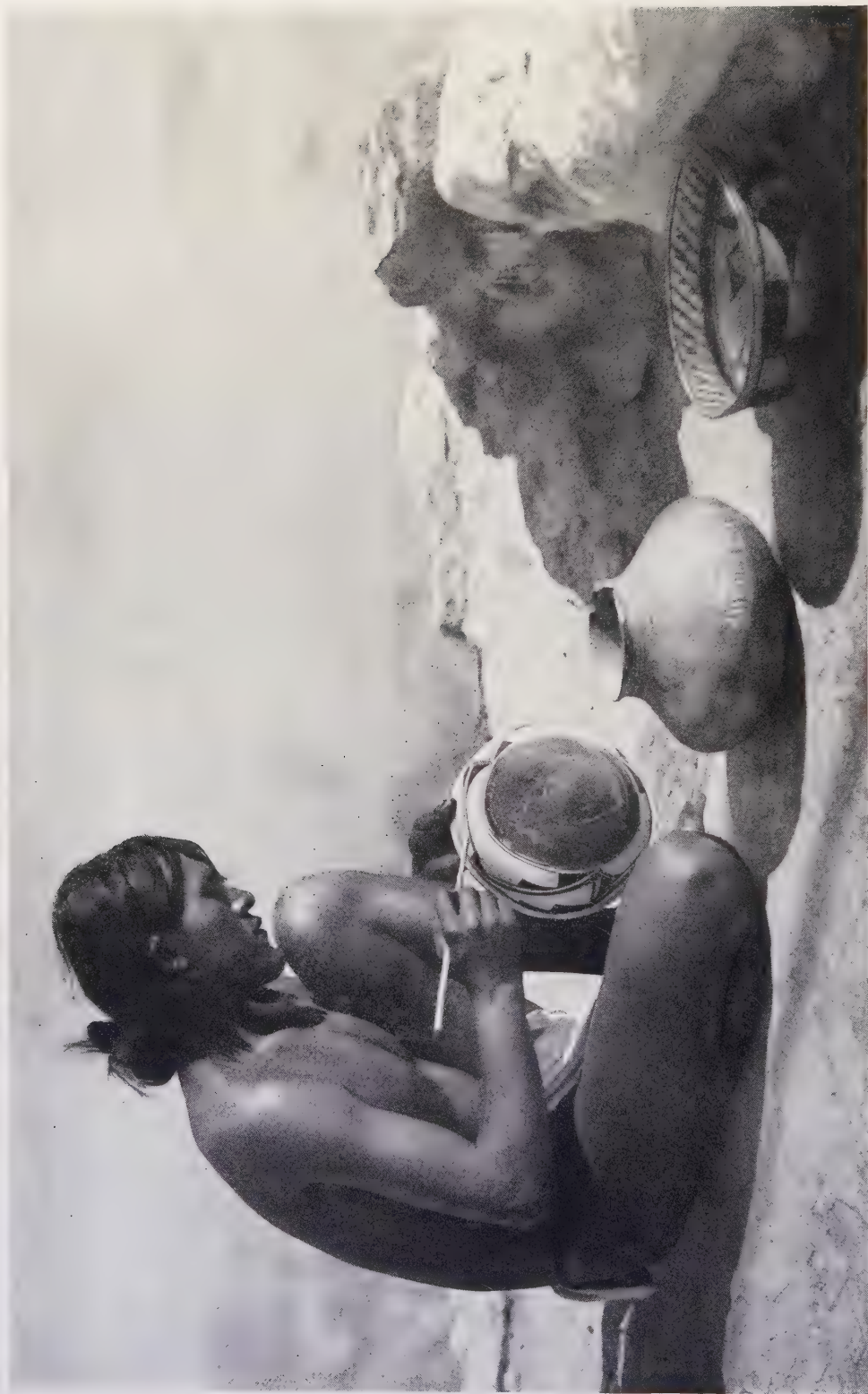
His grave was a bark-lined crevice between the foot of the cliff and a natural block. Unmindful of his presence, later occupants of the cave raised the floor full five feet by the gradual deposition of refuse and building waste. The Basket Makers probably came to Arizona from Mexico long before the time of the Pueblo culture, which had passed its zenith in 1540, at the time of the visit of the *conquistadores*.



Photograph courtesy: American Museum of Natural History

THE BURIAL BUNDLE OF AN AGED WOMAN

In preparation for interment, the body was flexed so that it occupied the least possible space, padded with fiber of the yucca plant, and laid across a leather-string blanket. Two bowl-shaped baskets, one within the other, were placed beneath the head and a very large one inverted over it; then the blanket was folded over to inclose them. A corner of the blanket has been turned back to reveal the magnificent basket.



© Roland W. Reed

THE POTTERY MAKER

The Indian Pottery Makers were products of a higher civilization than the Basket Makers. The former achieved the greatest development of their art in pre-Columbian America at Pueblo Bonito (see text, page 239). This worker is one of the Hopi Indians, who have inherited some of the skill of the ancient pueblo dwellers.



Photograph by Earl H. Morris

AT THE BRINK OF THE SLOPE IN FRONT OF THE GREAT CAVE:
CAÑON DEL MUERTO

It was Mrs. Morris who freed the specimens of the dust of ages and of the filth left upon them by a far from cleanly people. Desirous of seeing the patterns which washing would bring out upon the baskets, she waited eagerly while the photographer made the exposures necessary before the contents of the grave could be removed.



Photograph courtesy American Museum of Natural History

A MUMMY FROM THE LOOTED BURIAL, HIS WRAPPINGS
LAID ASIDE

The impression of the large, oval, turquoise mosaic which had been removed in pre-Columbian times may be seen just above the left wrist (see text, page 291). The mark of the basket which once covered the head is also visible across the breast. These "mummies" are merely desiccated bodies, since embalming was not practiced by any native American people.



A RARE ARMLET WOVEN OF CORD AND SHELLS

Usually the aboriginal grave robbers were disappointingly thorough, but occasionally there was a slip in their technique. They twisted off the legs from the body of this old woman and removed the baskets which were about the head, but they failed to raise the feather blanket which concealed an ornament unlike anything previously unearthed in the Southwest (see p. 291).



Photographs by Earl H. Morris

THE GRAVE OF A CLIFF-DWELLER BABY

The body was swathed in a feather-string blanket and lay on a mat of plaited rushes. By the head were single fragments from each of two pottery bowls, and beside the chin was a little jar filled with squash seeds. Upon the breast was a rattle made of five walnut shells strung on a cord. The baby's cradle, made of cottonwood bark, had been broken and the fragments placed as a covering for trunk and limbs.



Photograph by Earl H. Morris

PACKING DAY IN CAMP

During the bothersome task of adjusting mummies, pots, and baskets inside a limited number of crates, Mrs. Morris, Tatman, and Owens were almost envious of the mummies seated in the foreground.

for a brief moment had broken through the dark clouds masking the November sky.

DUST A MENACE TO LIFE

The preceding paragraphs record merely the most striking events during our explorations in Cañon del Muerto. Nothing has been said of days of tedium; of barren trenching, of measuring, of photographing; nor of the dust, which is a menace both to life and comfort. The least disturbance of the earth in these caves, where there has not been a drop of moisture for millenniums, stirs up a gray cloud so dense that sometimes one cannot discern even the outline of an assistant a shovel's length away (see page 294).

To work in such places, one must breathe through several thicknesses of moist cloth or face the consequence, which is a violent chill with a tendency to develop into pneumonia.

Nor have I mentioned the months of careful study which will be necessary before the thousands of specimens will have

told the last detail of their story. That story will reveal the cultural history of the aborigines of the Southwest previous to the arrival of the Spanish conquerors. Already the chapter heads have been translated and a brief of the pages written, but it will be many a year before the last paragraph is filled in.

Probably the exact date of the first human inhabitation of the Southwest will never be known, but by a conservative estimate it was all of 4,000 years ago. The first settlers of whom a trace has been discovered were an extremely long-headed people of medium stature. They were undergoing transition from nomadic to sedentary existence under the compelling influence of the cultivation of maize. This cereal, together with the few wild fruits and seeds which the barren environment afforded, augmented, of course, by the none too plentiful game supply, provided them with food.

Although their tools were of few types, and made exclusively of stone, bone, and wood, they were skilled artisans in several lines. They were past masters in weaving



Photograph courtesy American Museum of Natural History

MASTERPIECES OF PREHISTORIC TEXTILE ART

Aside from fur- or feather-string blankets, and narrow aprons in the case of the women, sandals were the only clothing ordinarily worn by the early inhabitants of the caves. Upon their footgear and upon their burden straps they lavished the utmost care, decorating them in colors, and in raised patterns produced by baffling, intricate manipulations of the weft threads.

and basket-making, and no Southwestern people has surpassed them as workers in wood. However, they had not learned to use the bow and arrow; to make pottery or to build walls of masonry.

These so-called Basket Makers, who probably emigrated from some part of the territory that is now Mexico, occupied the Southwest unmolested for a considerable length of time. Eventually, however, there came among them a roundheaded stock, bringing with it new manners, customs, and arts. From a blending of the two, there resulted the beginnings of the Pueblo culture, which, although it had passed its zenith before 1540, still survives.

The simple culture of the Basket Makers marks the beginning, and the creditable civilization which flourished in Pueblo Bonito, made familiar to the scientific world through the explorations of the National Geographic Society under the direction of Mr. Neil M. Judd, marks the culmination of aboriginal advancement in the Southwest (see pages 227 to 262).

The three or more cultural periods

which intervened need be only mentioned. The caves of northeastern Arizona were occupied during the entire range of the inhabitation of the region by sedentary agricultural peoples, and after the latter had departed, after even Pueblo Bonito had been given over to prairie dogs and owls and drifting sand, the Navajo arrived and found Cañon del Muerto a congenial dwelling place. To-day, in riding through it, one passes an occasional stunted peach orchard, a cornfield, a melon patch, or a squalid hut, and if one remains long enough, one becomes acquainted with the 40 or 50 Indians who now inhabit it.

They are a dwindling remnant. Within a few generations their blood will be extinct, or else their life and customs will have become so changed, as a result of contact with our own civilization, that they will no longer be real Navajo.

Thus, as far as aboriginal peoples are concerned, this gorge is truly a canyon of death, and the Spanish raiders struck deeper than they knew when they named it Cañon del Muerto.

NEW DISCOVERIES IN CARLSBAD CAVERN

Vast Subterranean Chambers with Spectacular Decorations Are Explored, Surveyed, and Photographed

BY WILLIS T. LEE

LEADER OF THE NATIONAL GEOGRAPHIC SOCIETY'S EXPLORATION OF CARLSBAD CAVERN, NEW MEXICO

CARLSBAD CAVERN, New Mexico, is the most spectacular of underground wonders in America. For spacious chambers, for variety and beauty of multitudinous natural decorations, and for general scenic quality, it is king of its kind.

Long known locally, this underground marvel was first disclosed to the readers of the NATIONAL GEOGRAPHIC MAGAZINE in January, 1924.* Following this publication, the National Geographic Society sent an expedition to explore further the cavern and the mountains near it.

The results of the explorations have proved that the early estimates of size were not excessive, and that the statements relating to the unusual nature of the cavern were in no sense exaggerations.

The cavern, which has been set aside as a national monument by President Coolidge, is situated in southeastern New Mexico, 26 miles southwest of the town of Carlsbad. It is the best known of many caves in a region of unusual beauty in the Guadalupe Mountains, a range which rises abruptly from the desert plain to altitudes of more than 9,000 feet (see map, page 232).

Among those who visited the National Geographic Society's camp at the cavern during our six-months' work were the governors of New Mexico and Texas, the Director of National Parks, and many other officials of both national and State organizations.

CAMP LIFE AT CARLSBAD CAVERN

One of the results of The Society's activity in holding up to the inspection of the world the glories of Carlsbad Cavern has been the creation of a State park in Texas, at the southern end of the high

part of Guadalupe range (see illustrations, pages 316 and 317).

Our camp was established at the mouth of the cavern, in the rough board shacks used by a fertilizer company years ago, when guano was being taken from the cave.† Water was carried by burro from the nearest spring, nearly a mile away, and wood was "rustled" from the mountain side, where a few stunted shrubs are found.

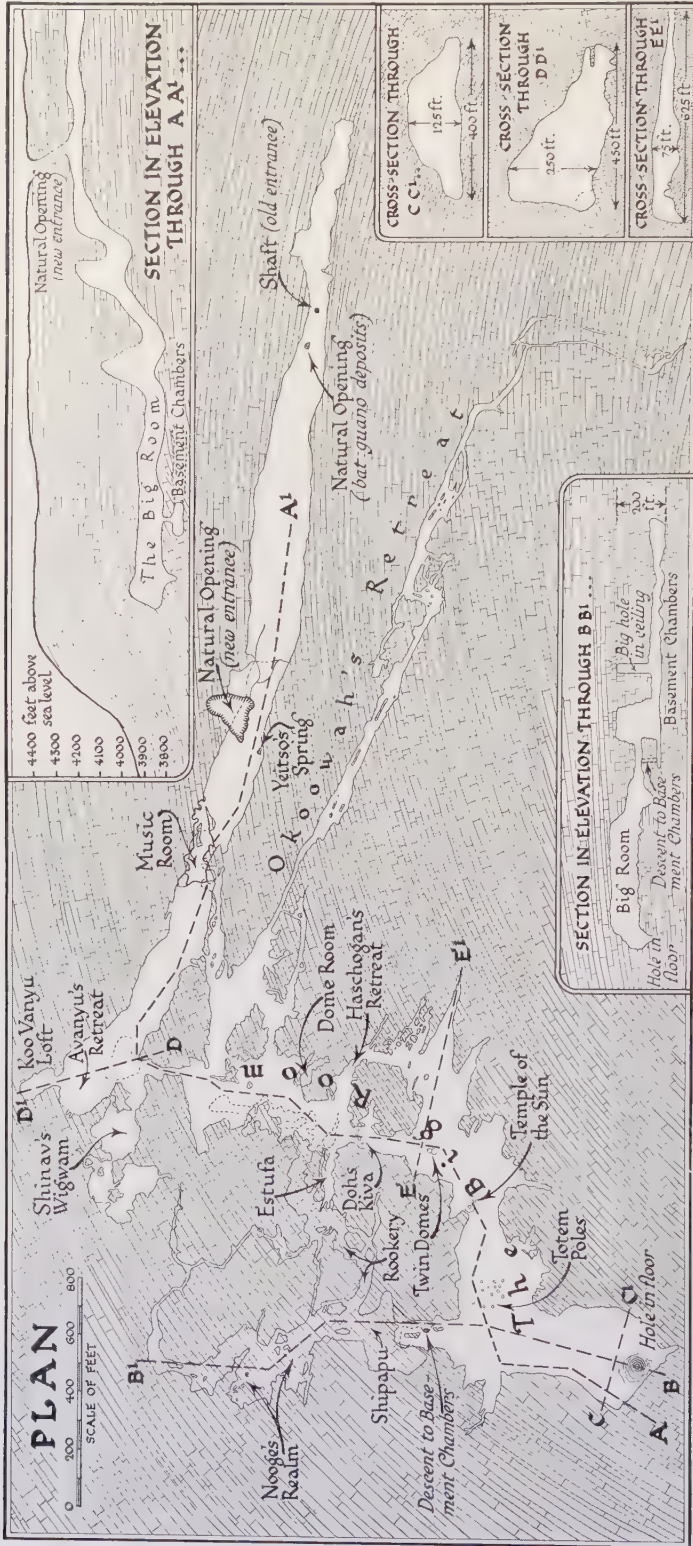
Supplies were carted from Carlsbad, 26 miles away. The first load was brought by a native team consisting of 4 mules, 4 burros, and 1 horse; it took the combined efforts of the 9 animals and 16 men to get a ton of provisions up the mountain side. After this experience supplies were brought by motor truck.

There was no refrigerator in camp, and there were no shade trees. Most of the time there were no clouds in the sky, and, while the nights were always cool, during the day the sun beat upon us mercilessly, the temperature hovering between 100° and 115° F. in the shade—and no shade to be found. There was, however, always the cool cavern, into which we could descend, where the temperature is uniformly about 56° F., and the small opening at the side of the elevator shaft served in place of a refrigerator. Perishable provisions were lowered 50 to 75 feet into this opening, where they remained cool and fresh.

The darkness of the cavern, its unbroken silence, and its unearthly aspect affected the workers in different ways. Some feared the dark and frankly confessed it; others feared and were ashamed of their weakness. Some were attracted by the mysteries of the unknown and were ever peering into dark corners; others clung tenaciously to the beaten path and were persuaded with difficulty

* See "A Visit to Carlsbad Cavern," by Willis T. Lee, in the NATIONAL GEOGRAPHIC MAGAZINE for January, 1924.

† See "Bats of the Carlsbad Cavern," by Vernon Bailey, page 321.



Drawn by Charles E. Riddiford from surveys by Willis T. Lee

A SKETCH MAP OF CARLSBAD CAVERN, WITH DIAGRAMMATIC CROSS-SECTIONS

to leave it. It was obvious that all who worked regularly in the cavern were under a mental strain.

LANTERNS PROVIDE THE ONLY ILLUMINATION

Exploration began about the middle of March and was carried on under circumstances quite out of the ordinary. New methods had to be devised for the simplest operations.

A supply of gasoline was needed in the cavern to refill lanterns. The surveyor filled a canteen, swung it over his shoulder, and started. The can leaked. He noticed a slight dampness in the clothing on his back, but gave it little attention until his flesh began to smart. Even then, not realizing that a gasoline blister may be serious, he continued to work for several hours. With the help of a doctor, he spent the next ten days in growing new skin.

The first work was to improve the trail, which was traveled each day to the more spectacular parts of the cavern, where most of the work was done. This extends for nearly three-quarters of a mile through a great subterranean vault



Photograph by Jacob Gayer

VUE IN THE CENTER OF THE BIG ROOM IN CARLSBAD CAVERN

At the left are two fluted columns of cave marble. At the right of these columns is a party of tourists standing amid the numerous coralline stalagmites. In the distance appear the Twin Domes (see, also, illustration, page 311).



Photograph by Willis T. Lee

PILLARS IN ONE OF THE LOWER CHAMBERS OF CARLSBAD CAVERN BROKEN BY THE
SETTLING OF THE FLOOR (SEE TEXT, PAGE 315)

This chamber, nearly 1,000 feet underground, has been named after the Indians' Nooge, or Place of Darkness, at the base of the universe, where, according to their legend, there is no sun, no moon, and no light. The man in the left middle distance is Jim White, the veteran guide.

100 to 200 feet wide, with a ceiling which at some points is nearly 300 feet high.

Each morning we descended into the Stygian darkness, and by the uncertain light of lanterns picked our way over and around and between great blocks of rocks, working our way downward to Shinav's Wigwam, 830 feet beneath the surface, where the highly decorated parts of the cavern begin.

The chambers previously explored were

used as points of departure for new discoveries. Tom Sawyer was emulated in the use of kite strings, and in time we had an elaborate system of avenues, with white twine markers all leading to the exit. If one became confused and uncertain as to direction, he followed the twine and soon came to the main trail.

Amid unearthly scenes, I not infrequently lost my sense of direction and I found myself confused in places where I



Photograph from Willis T. Lee

THE ARMORY AND SHINAV'S WAR CLUB

The entrance to Shinav's Wigwam is decorated with a great number of stalactites, whose gnarled appearance suggests the war clubs of cave men. Because of this suggestion the antechamber to the Wigwam has been called the Armory, or place where Shinav and his braves hung their weapons on returning from battle. The large stalactite of knotty aspect, to the right of which the author is seated, is called the war club of the Navajo's wolf god.



Photograph by Jacob Gayer

SHINAV'S WIGWAM, ONE OF THE MOST HIGHLY DECORATED CHAMBERS OF CARLSBAD CAVERN

This chamber is nearly circular in outline, 200 feet across, and 75 feet high. The floor is nearly level and has twice the area of the great rotunda of the National Capitol in Washington. Small passageways through the walls lead into neighboring chambers of equally ornate adornment. The walls of the Wigwam are decorated with pendants and draperies of white onyx marble in bewildering variety of form. Although the great chamber originated as a solution cavity, the original limestone walls are nowhere to be seen. The native rock is completely covered with the marble decorations.



Photograph by Willis T. Lee

THE ENTRANCE TO THE LOWEST LEVELS OF CARLSBAD CAVERN
In the right background is the lower end of the 90-foot wire ladder by which the explorers reached this level (see text, page 314).



Photograph by Jacob Gayer

A CURTAIN FOLD OF CAVE MARBLE RESEMBLING A PORTIÈRE
So closely does this material resemble fabric that one is impelled to feel of it before he is convinced that it is cold marble.



Photograph by Willis T. Lee

THE TAPESTRY WALL OF THE DOME ROOM

Many of the sheets of this stone drapery are translucent and less than an inch thick. Interesting effects may be obtained by placing lights back of the drapery in such a way as to bring out its varied color and texture. (For detail, see illustration, page 307.)

had been many times. All light available emanated from lanterns, so that what I saw at any one time was not an entire object, but the particular part of it that was illuminated. Thus, a familiar formation viewed from a new angle had a strange and unfamiliar aspect.

On this principle it will be possible, by the use of skillfully placed lights, which are soon to be installed by the National Park Service, to produce a great variety of spectacular effects in a restricted area.

One of the newly discovered chambers near Shinav's Wigwam was found when the surveyor's helper crept through a small hole in the wall of the Wigwam. The partition here is thin and a spectacular view, never before seen by human eye, opened to the astonished gaze of the venturesome assistant.

This new chamber, which we named Avanyu's Retreat, after the wise serpent of Indian mythology, contains several pools, about which are grouped many at-



Photograph by Willis T. Lee

A THEATER CURTAIN OF DRIPSTONE AT THE ENTRANCE TO THE MUSIC ROOM

Through uncounted ages water bearing carbonate of lime in solution has trickled from a crevice high in the wall, depositing its load of mineral matter in the form of a hanging curtain. Beyond this portière is a group of stalactites, which give forth musical tones when lightly touched (see text, page 313).

tractive decorations. One of the pools, which we called Mirror Lake, is about 150 feet long and is surrounded by delicately tinted onyx marble. The water of these pools appears deep blue in the white light of a gasoline lantern.

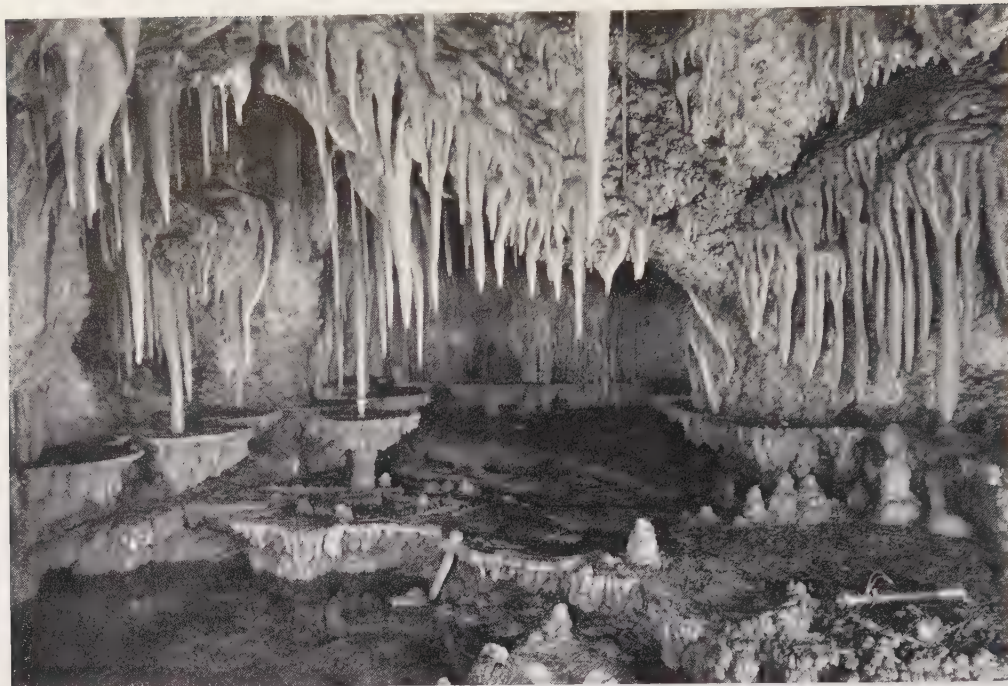
At the far end of the Retreat a good climber may make his way up a series of terraces of flowstone, about 30 feet high, to the Koo Vanyu, a chamber where the curious Medusalike formations known to

science as helictites suggest the Piros' Koo Vanyu, or stone snakes (see lower illustration, page 310).

A HILL, WITHIN A CAVERN UNDERNEATH A MOUNTAIN

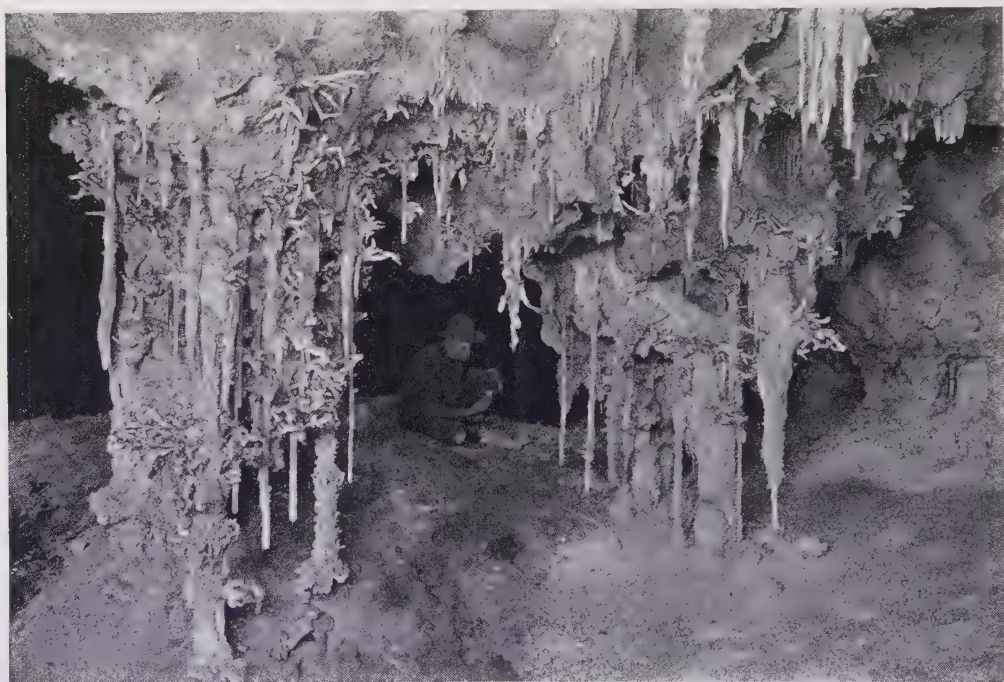
Many interesting nooks and corners about Shinav's Wigwam were thus explored and mapped; others, which are difficult of access, remain unknown.

On leaving the chambers grouped about



THE NECTAR FOUNTAIN

The white stalactites are the water pipes which supply the fountain, and the irregular shelf marks the maximum height of the water (see text, page 315).



Photographs by Willis T. Lee

EXAMINING THE "TREASURES" IN THE ANTEROOM OF SHINAV'S WIGWAM

Had the author of Arabian Nights seen the treasures of Koo Vanyu Loft, he might have enriched his tale of Aladdin and his lamp with facts stranger than the fictions used. The Piro's name Koo Vanyu, or stone snakes, is suggested by the Medusalike groups of helictites which adorn the pillars and stalactites of cave marble.



© Ray V. Davis

TWIN DOMES AND A PILLAR IN THE HEART OF THE BIG ROOM

The great fluted domes of cave marble rise 39 feet above the top of a mound of flowstone about 200 feet across and 50 feet high (see, also, page 303).

the Wigwam we were obliged to build a trail over a steep hill in order to reach the more spectacular part of the cavern. Here the ceiling of the great corridor has fallen and huge blocks of limestone lie on the floor. One of these blocks is 140 feet in diameter—a fragment that would tip the beam of some titanic scale at many thousands of tons.

The high part of the corridor rises more than 350 feet above the floor of the Wigwam; how much more was not determined, for the upper part of the cavity

could not be measured. In the original description of the cavern in the NATIONAL GEOGRAPHIC MAGAZINE, I estimated this height at 300 feet. The survey proved that this and other conjectures were underestimates.

On the side of the hill facing the Big Room, the blocks of limestone are covered with flowstone built up in beautifully terraced slopes, on which are fountain basins with bejeweled bowls.

We descended this terraced slope with care, for a false step might ruin many of



Photograph by Jacob Gayer

GENERAL VIEW IN THE BIG ROOM THROUGH THE ARCHED AVENUE BETWEEN TWIN
DOMES AND DOH'S KIVA

Great stalagmites of cave marble rise half way to the adorned ceiling, from which thousands of stalactites hang like suspended daggers.

the delicate ornaments. But this was not the only reason for our caution. On one occasion I lost my footing and slid down a beautifully terraced slope studded with lovely but sharp and unyielding crystals. The effect of this mishap remains with me in the form of impaired eyesight.

The great cavity called the Big Room is surrounded by tributary chambers of which little was formerly known. Near the portal of this room, at the side of a great mass of onyx marble, we found a

small hole. On stepping through it for the first time, I was startled at the magnificence of the scene which suddenly opened to view.

Here was a chamber, about 150 feet long, with walls and ceiling gracefully arched, which we called the Dome Room. From the arched vault hung pendants of ornate character, and on the wall were thin sheets of delicately colored onyx resembling portières looped back in graceful folds. One is impelled to touch these



Photograph by Willis T. Lee

PISOLITES ON THE FLOOR OF THE ROOKERY

These spherical bodies, about half an inch in diameter, are made up of concentric shells like pearls. This onion-shell structure results from deposition in water charged with calcium carbonate. Where the water from the ceiling drops with some force, a "nest" is formed and the "eggs" are prevented from becoming fast. The water flowing from the "nest" deposits sheets of rock material, which cements the previously formed "eggs" into a solid mass. These spherical bodies are known to geologists as pisolites and to jewelers as cave pearls (see text, page 315).

folds before he is convinced that they are cold, hard stone.

Another chamber, or series of chambers, near the Dome Room proved to be equally surprising, but in a very different way. A group of stalactites and stalagmites at the entrance suggests a giant portière (see illustration, page 309) and farther along a second group of stalactites gives forth musical tones when lightly touched.

One of the stalactites was accidentally broken and water began at once to flow

from its central tube. It proved to be excellent drinking water, and we sipped from this natural spigot whenever we passed.

A SERIES OF CHAMBERS AT A LOWER LEVEL IS EXPLORED

Toward the right, as one enters the Big Room, the trail ordinarily used ends abruptly at the brink of a chasm, where one gazes into a pit 90 feet deep and nearly 300 feet across.

The domed ceiling of this spacious ro-



© Ray V. Davis

THE DOME ROOM, CHARACTERIZED BY GRACEFULLY ARCHED WALLS AND
DOMED CEILING

This chamber is about 150 feet long by 50 feet wide, and is profusely decorated with pink and lemon-yellow marble in forms which baffle description. The two slender pillars rise from a fountain basin of crystalline onyx marble, which has formed at the surface of the water in shapes resembling lily pads. Many of the pendants and thin sheets of marble are in the form of wavy folds of drapery.

tunda is about 200 feet from the floor of the pit and is decorated with pendants of onyx marble, while the walls are adorned with tapestrylike trappings of flowstone.

Wire and rungs were brought into the cave and a ladder was constructed. This was lowered over the brink, the lower 75 feet of the ladder swinging clear of the wall (see illustration, page 307).

A wire ladder has an erratic nature and an obstinate disposition; it has a tendency to be where it does not belong. Those who first descended had an unhappy time

swaying and spinning about in the darkness. Later the ladder was anchored, but those affected with weak nerves did not enjoy the climb.

At the foot of the ladder we found ourselves in a highly adorned corridor about 150 feet long, with a floor composed of a succession of fountain basins partly crusted over with onyx marble, formed about the rim at the surface of the water as ice forms over a pool.

Before the ladder was built, Jim White, the guide, went down the hole on a rope.



Photograph by Jacob Gayer

THE "BILLING DOVES"

A curious remnant of limestone has been left by the solution of the rocks about it. The resemblance to birds' heads is striking when viewed from a certain point. Such freaks in the great solution cavities of Carlsbad Cavern keep observers busy imagining resemblances to familiar objects and suggesting analogies.

He carried a kerosene torch, which gives little light and much smoke. By such fitful gleams things look weird and unreal. All went well until he reached the water at the bottom of the hole. To his perturbed mind this seemed like an ocean. His frantic signals to be raised were misunderstood and he was dropped unceremoniously into the pool. With light gone, he passed an unhappy moment in pitch darkness before he discovered that he could touch bottom.

Under the dome stand numerous stalagmites, like pedestals in a hall of fame; over them hang great pendants, like sharp-pointed daggers. One instinctively stands from under the great masses which seem so precariously fastened, for the fact that they have hung securely for thousands of years does not reassure the nervous explorer. Especially is this true as he stands beside a mass of similar material which *did fall*—a mass which would weigh 100,000 tons and which fell 200 feet from the ceiling!

Of the two main avenues leading from this central rotunda back into mysterious places, that to the left is profusely decorated, the stalactites seeming to push forward for attention, as if each were trying to say, "Behold me! In this basal darkness I have waited 10,000 years for one admiring glance."

A surprising phenomenon was found here. Solution is gradually removing material and the floor is slowly sinking, with the result that great columns have been snapped asunder and drawn apart (see illustration, page 304).

A DRINKING FOUNTAIN WORTHY OF THE GODS

The avenue to the right leads to the Rookery, so called because of its many egglike bodies of cave marble. Over a considerable area the floor is covered with these bodies, known to geologists as pisolites and to the jeweler as cave pearls. The "eggs" occur singly and in groups. Some have grown fast to the floor; others



Photograph by Willis T. Lee

A CAMPERS' PARADISE IN THE NEW TEXAS STATE PARK (SEE PAGE 301)

The precipitous limestone walls rise sheer from the waterholes, where the deer and bighorns come down to drink and where an occasional bear, unaccustomed to the ways of man, comes to inquire as to the state of the camp supplies.

are unattached, probably because of the slight rocking motion imparted to them by the water dripping from the ceiling (see illustration, page 313).

Like real pearls, these cave pearls are built up layer on layer by calcium carbonate deposited from the water. Some of them have smooth, glistening surfaces; others have a dull luster.

An alcove of unusual beauty was found near the Rookery. We entered through a maze of pendants, some of which were

destroyed in spite of all precautions. Within the alcove is a pool of water so beautifully adorned that we called it the Nectar Fountain (see page 310).

PICTURESQUE MOUNTAINS AND DESERT
PLAINS

As exploration was extended beyond the Rookery, we found that the basement chambers turned and came back under the middle of the Big Room.

The mountains and plains in the vicin-



Photograph by Willis T. Lee

THE HEART OF THE NEW TEXAS STATE PARK (SEE MAP, PAGE 232)

In the right foreground is the National Geographic Society Expedition's camp at the water hole in Guadalupe Canyon, at the base of a magnificent escarpment which rises a vertical mile above the plain.

ity of the national monument are scarcely less interesting than the cavern itself. It is a land of alkali flat and soda lake; of sun-parched slope and barren crag; of cactus and mesquite; a land of coyotes, and rattlesnakes, and horned toads.

The characteristics of the desert are everywhere in evidence. The prairie dog chatters and scolds at one's approach, and with a saucy flip of his stubby tail disappears into his burrow. The jack rabbit bounds away on his angular course over the bunches of broomweed and between the thorny shrubs. The hot, dry whirlwinds raise spirals of pungent dust, which quiver in the shimmering atmosphere.

The spell of the desert is here; it is the

Wild West, the land of adobe shack, of range cattle and goats. The picturesque cowboy in sombrero and chaps is a familiar figure, and although the bandit no longer roams at large, men still living tell of adventures with Billy-the-Kid and Black Jack.

One of the old pioneer trails, a route of the gold seekers of '49, known as the Butterfield Trail, crosses this plain. The old-timers remembered the whitened bones of the oxen that perished on the long stretches between water holes.

The Guadalupe Mountains rise from the plains like a rampart out of the sea. Far from the ordinary lines of transcontinental travel, few eyes have beheld their



Photograph by Willis T. Lee

SITTING BULL FALLS, NEAR QUEEN, NEW MEXICO

The water with calcium carbonate in solution issues from the rocks high in the canyon side and flows over the rim, where it has built a canopy of travertine, which roofs a cave about 100 feet deep. Note the human figures against the black background of the cave.



Photograph by Jacob Gayer

A YOUTHFUL SHEPHERD AND HIS NANNY: NEW MEXICO

The piles of rock are shelters from the sun's heat, to which the young goats are very susceptible.

glories. A great earth block composed chiefly of limestone has been lifted until its crest is more than a mile above the plain. Erosion has carved this block into a series of deep gorges and crested ridges.

Among the crags of these rock-ribbed fastnesses live bighorn sheep and bear and deer. Along the streams in the canyons are delightful camp sites, where wild creatures come down to drink, and where a friendly bear occasionally interviews the camper and inquires as to his intentions of remaining where he is not particularly welcome (see pages 316 and 317).

From these camping places near the streams and springs the limestone walls rise in rugged grandeur. I know of no place in America where the trailmaker and the landscape artist can find more spectacular effects.

On a properly constructed trail, in a day's trip in the saddle, one could pass from desert plain, over a craggy mountain slope, to a crest more than 9,000 feet high.

In this region, adjacent to the southern border of New Mexico, Texas has selected an area (see map, page 232) for a State park.



Photograph by Willis T. Lee

THE NATURAL OPENING TO CARLSBAD CAVERN (SEE MAP, PAGE 302)

The author of "Bats of the Carlsbad Cavern" is seen catching bats with his net (see text, pages 321 to 330).

BATS OF THE CARLSBAD CAVERN

BY VERNON BAILEY

BIOLOGIST, BIOLOGICAL SURVEY, U. S. DEPARTMENT OF AGRICULTURE

BATS—celebrated in art, story, and drama as emblems of evil and darkness, associated with Satan and the infernal regions, supposed to be teeming with vermin and prone to entangling alliances with ladies' hair—are one of our least-known and most-maligned groups of mammals; least known because they are highly nocturnal and rarely seen except in semidarkness, and because in daytime they hide away in dark places, which are rarely accessible except to prying naturalists.

Many intelligent people ask whether they are reptiles or birds, and my boy scouts always want to know whether I mean leatherwing bats or bull bats.*

So strong are superstition and imagination that constant reiteration of some of the well-known facts regarding the habits of bats seems necessary to an appreciation of their great value to man.

Bats are mammals of a very old and highly specialized group. They were hanging upside down in caves long before the first cave man came to join them; and, while they may not have acquired great mental powers, they have developed special senses of which man has little knowledge or appreciation. They have progressed along so many different lines that they now form one of the very large orders or groups of the mammals of the world, represented in America by numerous families, genera, and species.

Many of the families and genera are world-wide in distribution, and in G. S. Miller's latest list of the Mammals of North America 252 species of bats are given. Still, to most people a bat is a bat, without regard to a wide range of habits and structural differences.

BATS ARE CLAD IN FUR AND HAVE SHARP
TEETH TO CHEW THEIR FOOD

Although clothed in fur instead of feathers, their powers of flight are comparable to those of birds, or even superior

* It seems almost unnecessary to say that "bull bats" are nighthawks, birds related to the whip-poorwill.

for their purposes. On their wide, elastic wings they can fly slowly or rapidly, and make the necessary short turns in air to capture their insect prey.

With minute eyes and apparently short range of vision, and even with eyes covered, they detect and capture their prey in the air, avoid all solid objects, or even the finest wires or strings stretched in their paths, and find their way through long and intricate passages with no trace of light to guide them.

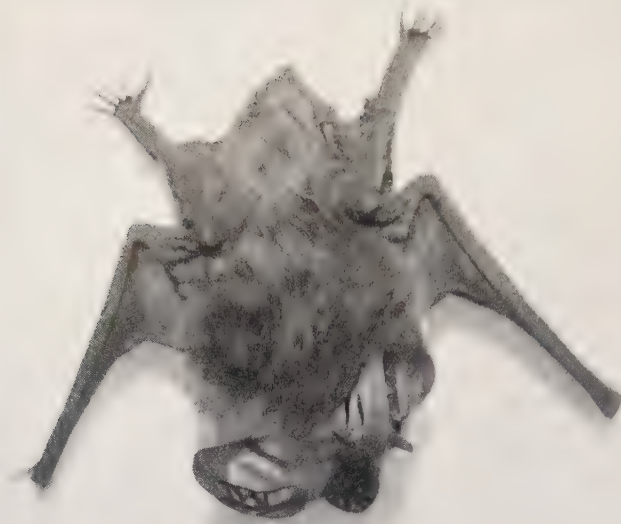
Strangest of all, they wander far and wide over the country at night in search of food, and with unerring sense return at daybreak to the same place to sleep, and guided in some way unknown and incomprehensible to us, some make migratory journeys north and south over continental areas and wide stretches of ocean.

BATS FEED RAPIDLY AND CONSUME GREAT
NUMBERS OF HARMFUL INSECTS

All of the bats of America north of the Tropics are entirely insectivorous, feeding upon and controlling the abundance of the night-flying insects, just as the birds do the daylight species. They feed rapidly and consume great numbers of insects; their stomachs are large, and after a half hour of feeding sometimes weigh a quarter as much as the whole animal. On the basis of only two full meals in a night, which may be far too low an estimate, bats would consume half their weight in insects every 24 hours.

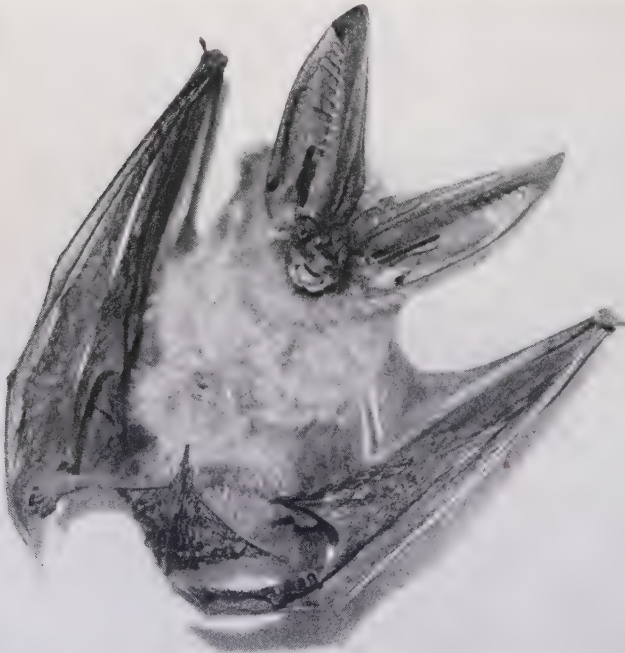
The insects eaten are not easily identified, as bats have good teeth and chew their food to the finest bits. The wing scales of moths and the hard particles—jaws, legs, shells, and wings—of beetles and flies form a large part of the recognizable stomach contents, but other night-flying insects are also extensively eaten. Mosquitoes, gnats, and such delicate insects are rarely recognizable in their food, but undoubtedly form some part of it.

So far as we know, the insects eaten are mainly our enemies and might, in unchecked abundance, injure or destroy our forests and crops.



A BAT WITH EARS UNROLLED AS IT AWAKENS

When the bat is cold and torpid in hibernation its ears are coiled up at the sides of the head. This one is warming up in the sunlight and the ears are slowly uncoiling (see, also, text, page 329).



Photographs by Vernon Bailey

BAT HELD IN FRONT OF CAMERA TO SHOW THE EARS

The antitragus, a slender filament inside of the ear, is supposed to be a delicate instrument for catching waves of sound or motion.

It is not improbable that bats are as necessary as birds in preserving that balance of Nature which renders this earth a reasonably comfortable habitation for man.

On close acquaintance, bats are found to be intelligent animals with very interesting habits. They are cleanly and not more subject to parasites than other animals. The chinchbug sometimes carried by them is not the species which infests our houses and causes so much annoyance.

There is no record of bats ever becoming entangled in the hair of anyone, and nothing could be further from their habits or inclinations. They will bite and fight savagely in self-defense, if captured and held against their will, but if handled gently they are quiet and intelligent, and in captivity soon learn to watch for the hand that feeds them.

MOTHER BAT CARRIES HER YOUNG IN FLIGHT

Most species of North American bats have but one young a year, born in June and carried about by the mother until old enough to fly and catch its own food.

The young are very large at birth, in some species weighing a quarter as much as the mother. They have no nests, but as the mother hangs head downward, by her hooked hind claws, the young cling to her body or are folded under her wings, where the two nipples are conveniently

arranged on the sides of the breast, just above the cradle of her warm, fur-lined armpits.

During the mother's flight the young, even when half grown, cling to her body and are carried about in her nightly search for flying insects. They fly considerably before becoming full grown, and apparently develop very rapidly from birth to the time of their first flight.

The mating season of most of our bats is in late summer or autumn, but the embryos usually show little development until the following spring.

Soon after the bats in the Carlsbad Cavern awoke from hibernation the embryos were still minute and in some individuals could scarcely be detected. In others they were perfectly formed, with a well-developed vascular system. By April 24 they were as large as small buckshot, and by May 7 the size of a .44-caliber bullet. They steadily increased in size until June 13, when they were fully developed, as large as marbles, and ready for birth. One examined on this date weighed 3.6 grams, while the mother weighed 13.6 grams.

The birth of these young, fully a quarter as large as the mother, would not be possible except for the low and widely separated bones of her pelvis. Even then it is almost inconceivable that she could give birth to a young comparable to a 33-pound, two-year-old child of the human mother.

THE BATS HANG IN VAST COLONIES FROM CEILINGS OF CAVERN

With but one young a year, it would seem that bats must live long to keep up their normal abundance, but there appear to be no available data as to their longevity or as to what becomes of them when their life cycle is closed. Generally they have



Photograph by Vernon Bailey

THE FACE OF AN ANGRY BAT

Caught and held in front of the camera against their will, these mammals express their rage with fierce looks and squeaks and use their keen little teeth on anything within reach.

few enemies, and their abundance is probably limited only by the normal food supply.

The bats of the Carlsbad Cavern are mainly the Mexican Free-tailed, *Tadarida mexicana*, the famous guano-producing species of Mexico and the southern United States. Their habits of roosting in enormous colonies in caves or buildings has given them a special value in the production of great quantities of guano, a product much prized as a fertilizer.

They differ from most of our northern bats in the projecting tail, which reaches about an inch beyond the attached membrane; in short, wide ears, short, close fur, and a strong, musky odor peculiar to the species. They are not the only species of bat in the great cavern, but are so numerous that the others are little noticed (see illustrations, pages 325 and 327).

Their numbers vary at different seasons, apparently reaching the maximum in late summer and early fall, when they gather for the winter's sleep, and the minimum about the first of May, when



Photograph by Vernon Bailey

THE FRINGED BAT (SEE TEXT, PAGE 330)

This is one of the Small-eared Bats, *Myotis thysanodes*, widely distributed over the southwestern United States and Mexico, and a regular inhabitant of caves.

many have left for lower country and better feeding ground.

On a warm evening in early May, about 10,000 came out of the cave—their numbers partly counted and partly estimated. From descriptions of the dense cloud of bats coming out in August, the numbers must run into hundreds of thousands, if not to millions, and such estimates would be necessary to account for the great deposits of guano taken out of the cave.

The conditions of temperature, moisture, and space in this great cave seem to suit the bats better than those in any other of the numerous smaller and drier caves of the region. The enormous rooms in which they cling for their winter sleep to the ceiling 150 feet above the floor are very uniform in temperature, varying only from 55 to 60 degrees Fahrenheit, from early March with its freezing weather to hot days of May, and is said to show no noticeable difference in temperature throughout the year.

The air of the cave is moist and heavy with the musky odor of bats, an odor that with a favorable wind can be detected outside half a mile from the entrance. To the bats this odor may be recognizable at a much greater distance and serve a

very useful purpose in bringing them back from their nightly wanderings and from their seasonal migrations.

GUANO DEPOSITS COLLECTED DURING
THOUSANDS OF YEARS

The guano deposits, composed entirely of insect remains, reach back into geologic ages, lying under huge stalagmites that have been thousands of years in forming.

When first brought to commercial notice, in 1901, the guano filled some of the largest rooms to a depth of 100 feet, coming up nearly to the natural openings and sloping away for hundreds of yards over the cave floor. From all records now available, the estimates of 100,000 tons of guano taken out of the cave seem not too high. Most of this has been shipped to the California Fertilizer Company at San Bernardino, California, and sold at prices ranging from \$20 to \$75 a ton.

The guano remaining in the cave would make but a few carloads, and most of it is old, mixed with earth, and of low grade as a fertilizer.

A special effort was made to determine the rate of deposit of the guano, but with little satisfaction, because of the cold weather of March and April, the conse-



ON THE WING, THE GUANO BATS ARE STRONG AND SKILLFUL FLIERS (THIS SPECIMEN AND ITS QUARRY HAVE BEEN POSED BY THE PHOTOGRAPHER)

They hunt their insect food at night, capturing and devouring beetles, moths, flies, and a host of winged insects of nocturnal habits. The guano deposited under their roosts in the caves is composed entirely of insect remains. How many insects would be required to make 100,000 tons of guano? (See text, page 324.)



Photographs by Vernon Bailey

THE LARGE BROWN BAT, ABOUT TWO-THIRDS NATURAL SIZE

This is the commonest bat in Slaughter Canyon, near the Carlsbad Cavern, where great numbers come to drink at the water tank in the evening. In summer this bat lives mainly in the northern, forested regions of the continent, but in winter it is probable that it seeks more comfortable quarters in the south (see text, page 329). Note how the knees of a bat bend backward.



Photograph by Vernon Bailey

A MOTHER RED BAT AND HER FAMILY OF FOUR YOUNG

This mother bat was brought into the National Museum just as she was found hanging to a twig in a maple tree. Each of her four young was clinging to a nipple with its mouth and to the mother's fur with its twelve hooked claws. The four young weighed 12.7 grams, while the mother weighed only 11 grams, so they were a little more than a quarter grown. They showed no inclination to let go, and it must be inferred that the mother carries them while flying in pursuit of insect prey until they are old enough to hang up in the tree and wait for her return, or to fly and catch their own food (see text, page 330).

quent inactivity of the bats, and the resulting slight deposits of guano.

I could not catch sufficient insects to satisfy the appetites of my captive bats, and thus test the rate of deposit. The bats evidently could not catch enough insects during the cool nights to fill their stomachs, which on the return to the cave in the early morning were not more than half full. Stomachs of bats coming out in the evening usually were empty.

Under the densest part of the bat colony, on April 29, a paper 20 by 30 inches was spread to catch the droppings. In 44 hours it caught 1,145 pellets, which weighed at first 5 grams and when air-dried 3.7 grams. These did not more than half cover the surface of the paper, so that a single layer of droppings about 2 millimeters thick would have required over 2,000 pellets and about 4 days of time.

The fact that in the three years since any guano has been removed from the cave there have accumulated no deposits more than three inches in depth would indicate a very slow rate of deposit, even where the bats are very numerous.

One inch a year of fresh pellets would certainly shrink to half an inch when disintegrated to dust and packed and settled into the solid mass of the old, deep guano, rich in nitrogen, phosphoric acid, potash, and other valuable elements of plant growth. Even under a large colony of bats, it would seem

that 50 feet of guano might well represent the food refuse of more than 1,000 years.

But for most of the bat colony this cave is a winter resort rather than a summer home. In other caves farther south, where the bats live both summer and winter, the rate of deposit is much more rapid. In a smaller cave near San Antonio, Texas, about 60 tons of bat guano have been taken out annually for 29 con-



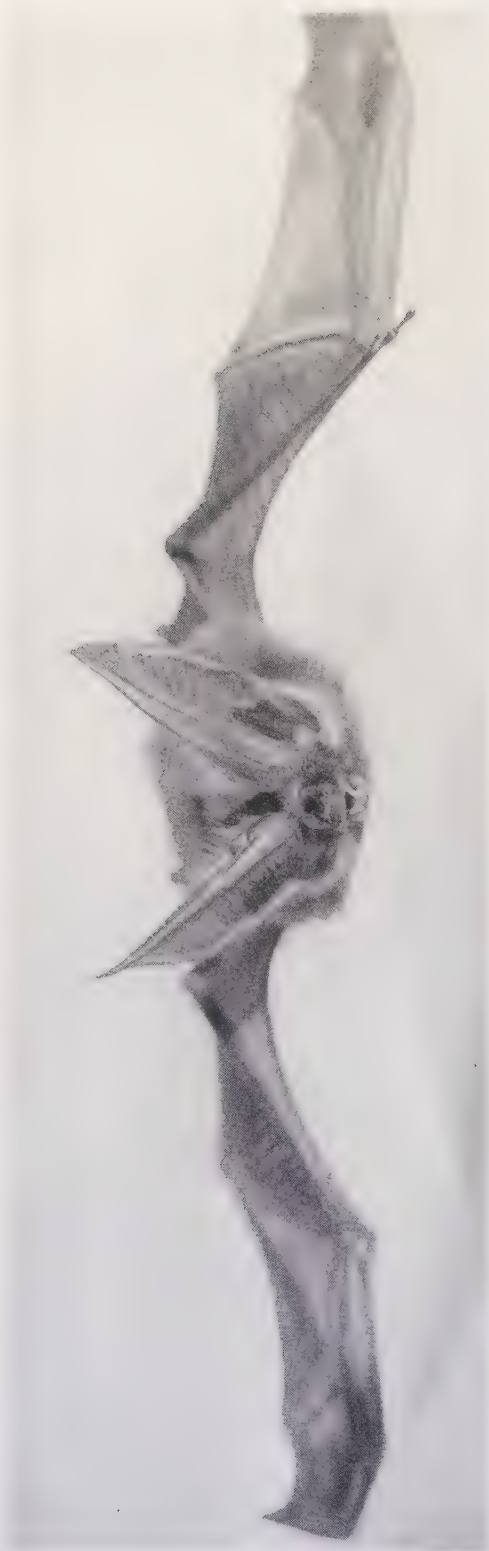
PHOTOGRAPH OF A MOTHER RED BAT WITH WINGS AND TAIL, HELD BACK TO SHOW THE FOUR YOUNG CLINGING TO HER BODY (SEE, ALSO, OPPOSITE PAGE)



Photographs by Vernon Bailey

THE FREE-TAILED OR GUANO BAT

These bats belong to a mainly tropical family reaching into the southern United States, and are very different from our northern species in structure, habit, and odor. The tail projects about an inch beyond the attached membranes, the ears are short and wide, the fur close and oily. They have a strong, musky odor and are more extensively colonial than are any other of our North American bats.



Photograph by Vernon Bailey

THE LONG-EARED BAT, SOMETIMES CALLED THE JACKASS BAT, OR JACK RABBIT BAT

These bats are cave dwellers, but never in great numbers. A dozen or a hundred or a few hundred are sometimes found together in a cave, or in summer in an old building.

secutive years, and other caves have yielded comparable amounts.

A good productive bat cave has the advantage over a gold mine in being self-perpetuating.

But the real value of the bats lies in their enormous destruction of insect pests, which is well illustrated by a permanent yield of 60 tons a year of insect shells in one locality.

THE LONG-EARED BAT STUDIED DURING HIBERNATION

Besides the vast numbers of Free-tailed, or Guano, Bats, which hang close together under the roof of the highest room in Carlsbad Cavern and by their rank odor apparently keep other bats at a distance, there are about a dozen species that occupy, or have occupied, various parts of the cave or near-by caves and canyons. Of the 18 species of bats known in New Mexico, 13 have been found in this vicinity.

In the farthest, deepest room of the cave, where there were no living bats, numerous skeletons were found lying on the dusty floor. They were usually old and bleached, but some were dried mummies that may have been there for many years. Most of these were of the Guano Bats, but they included also bones of many other species.

The Long-eared Bats, *Corynorhinus rafinesquii pallescens*, one of the most interesting and spectacular species of the region, were found in considerable numbers in McKitterick Cave, some 20 miles farther north. On April 15, when first discovered, they were still in profound winter sleep, hanging head down from the low limestone ceiling and on the rock walls of the cool, dry rooms, their great ears rolled up in spiral coils like rams' horns on each side of the head.

Their bodies were cold and apparently lifeless, their respiration and circulation reduced to the minimum, and all the bodily functions greatly retarded. Unfortunately, I had no thermometer with me, but the temperature of the rooms was apparently about 60 degrees Fahrenheit and the bodily temperature of the bats approximately the same.

Here the bats had hung all winter, nourished by their store of fat and bodily fluids and still in good condition. When brought out into the warm air they soon uncoiled their ears, stretched their wings and legs, and when handled opened their little red mouths and squeaked protestingly. Some which were kept for several days in a cloth bag hung up in my room were warm and active during the daytime, but when the temperature dropped below 60 degrees, as it usually did at night, they rolled up their ears, became cold and torpid again, and in the morning were in a state of hibernation (see page 322).

The Large Pale Bats, *Antrozous pallidus*, are common bats of the region, but none was found alive near the cave, or nearer than Carlsbad, 26 miles distant. In summer they are generally found living in houses, barns, cliffs, and small, dry caves, but little is known of their winter resorts.

In Slaughter Canyon, about 15 miles west of Carlsbad Cavern, dozens of their decaying bodies were found in an iron water tank at the goat ranch, where they had fallen in while drinking and had drowned. The tank was about 20 feet across and only 5 feet deep, but these large bats evidently could not drink from the surface of the water so quickly as to be able to rise again before striking the sides. No smaller bats were found in the tank, although many came to drink.

A number of bat skulls or jaws were found among the owl pellets on the floor of the Bighorn Cave, in the west branch of Slaughter Canyon, where they may have been roosting, or may have been brought in by the Great Horned Owls which nest in the cave.

The Large Brown Bats, *Eptesicus fuscus*, were represented in the Carlsbad Cavern by an old skull and wing bones found on the floor of the deepest room, where they had lain for many years.

Among the numerous bats seen outside, flying about at night, they may have been common, but only in Slaughter Canyon were any specimens taken. Here they were apparently the commonest bat, coming in by dozens to drink at the water tank in the evening and approaching from the direction of the large, open Slaughter Cave near there (see page 325).

In summer these bats are found mainly in the higher, timbered zones in the mountains, from New Mexico to Canada, and across the middle part of the continent, where they are an abundant species, especially in the forested regions. It seems probable that they come down to this level to find comfortable winter quarters, either in the caves or far back in cracks and crevices of the canyon walls.

SILVERY-HAIRED BATS BREED IN CANADA

At Oak Spring, from which we obtained water for camp use while working in the cave, one of the Silvery-haired Bats, *Lasionycteris noctivagans*, was obtained by Dana Lee as it came in to water, on the evening of April 12, and a few days later a couple of others were seen in Walnut Canyon, near there. Their very black color throughout renders them conspicuously different from other bats when they first begin to fly, in the early twilight, for the silvery frosting on the back does not show while they are on the wing.

They are northern bats of migratory habits, breeding mainly in the Canadian Zone of the mountains or far north, and moving, at least in part, to lower levels or lower latitudes for the winter. There are few records of their occurrence in New Mexico, but some of the caves of this region may afford just the right degrees of temperature and humidity required for their winter sleep.

Any cave that offers winter quarters for these defenders of our northern forests should be given special protection.

The House Bat, *Myotis incautus*, was represented in the lowest room of the great cave by several fragments of old skulls which may have been there for many years, but in another cave near Carlsbad about 1,000 of these bats were hanging to the low roof within easy reach of my hand. They were readily photographed in a very lively moving picture,

as they broke away from the solid mass in which they had been huddled together.

One of the Fringed Bats, *Myotis thysanodes*, was found in a rain barrel close to the open ladder shaft of Carlsbad Cavern. It is largely a cave-dwelling species, and this one may have come out of the shaft and, in attempting to drink from the water in the barrel, have fallen in and drowned (see page 324).

The Cave Bat, *Myotis velifer*, and the Little California Bat, *Myotis californicus*, have a general distribution over this region, but the only specimens taken at the cave were skulls picked up in the big dry room at the farthest end and lowest level. These remains and the traces of guano in this chamber are so old as to suggest a former entrance now closed or hidden.

The tiny Canyon Bat, *Pipistrellus hesperus*, easily recognized by its small size, whitish fur, and very black wings and ears, was often seen early in the warm evenings, flitting about in the big western doorway of Carlsbad Cavern, where it probably lived in the cracks and small openings of the cliff, rather than down in the dark chambers. It was also the most abundant bat along the canyon walls and at Oak Spring, just over the ridge, where hundreds came to drink every evening. Its very small size would suggest quite a different set of food insects from those eaten by the larger bats.

A jawbone of this little bat picked up with other bones from owl pellets under the nests of Great Horned Owls in the Bighorn Cave, in Slaughter Canyon, does not necessarily mean that they live or winter there, although this is probable.

The Great Hoary Bats, *Nycteris cinerea*, largest of our northern bats and conspicuous by their short ears and silvery-gray fur, are not common in New Mexico and occur mainly as migrants from their northern or mountain homes to southern winter grounds. They have been found as far south as Brownsville, Texas, and southern California, but where or how they spend the winter has never been known.

In summer this species is generally found during the day hanging head downward in some dense foliage of trees or bushes and, so far as we know, is not given to entering caves or buildings.

Wing bones of several individuals were found on the floor of the deepest, farthest room of the cave, which would suggest this as a wintering place for the species.

Jim White, for many years in charge of the guano mining operations of the Carlsbad Cavern, told me of finding a very large gray bat hanging in the leaves of a walnut bush in the canyon below the cave and making a fierce little noise like a miniature cat fight. This could have been no other than the Hoary Bat.

A MARVELOUS EXHIBITION OF POWER OF FLIGHT

The Red Bat, *Nycteris borealis*, has never before been recorded from New Mexico, but the southern part of the State is well within its range. Two old skulls found among other bat remains on the floor of the farthest, deepest room of the cave would suggest that this chamber farthest away from the colony of Guano Bats was used as a wintering ground by the Red Bat as well as by several other species. While mainly tree bats, hanging during the day in the leaves of trees or bushes, they are known also to enter caves and may seek such quarters for winter hibernation.

Unlike most bats, the females have four mammae, and two to four young have been found clinging to their mother, their combined weight considerably exceeding hers (see pages 326-327).

These mothers were found hanging in trees and were not actually observed in flight with their burdens of young; but the inference is that they must carry the young about with them in pursuit of their regular prey, flying insects captured in the air. Where is there another example of such power of flight by bird or beast?

Early reports that the bats were the only animal life in the Carlsbad Cavern have been disproved by the discovery of several other mammals and two cave crickets occupying its whole extent, while a number of insects, spiders, and a myriapod occupy the first large rooms, where there is still a trace of reflected light.

Many other mammals and some birds live in the gloomy halls of the entrance shafts, either permanently or temporarily, and still more in the immediate vicinity outside.

EXPERIENCES OF A LONE GEOGRAPHER

An American Agricultural Explorer Makes His Way Through Brigand-infested Central China en Route to the Amne Machin Range, Tibet

BY JOSEPH F. ROCK*

AUTHOR OF "THE LAND OF THE YELLOW LAMA," "BANISHING THE DEVIL OF DISEASE AMONG THE NASHI," AND "HUNTING THE CHAULMOOGRA TREE," IN THE NATIONAL GEOGRAPHIC MAGAZINE

MUCH of a most unpleasant nature has happened to me in recent months. I was delayed about one month in Yünnanfu on account of my Nashi assistants, who were held up by brigands between Talifu and the capital (see map, page 334).

Between Yünnanfu and Tungchwan, in east Yünnan, we met brigands twice and had some real scares. A number of the people who followed in my train for the sake of protection lost some of their belongings and two loiterers were captured.

From Tungchwan to Chaotung is five days' journey north and just two days out of Tungchwan I had the most terrible experience of my life. I had been informed that there were about 1,000 brigands between the two places, and that the road was practically closed. The magistrate of Tungchwan assured me, however, that all the brigands were in the Chaotung district. He said he would send 20 soldiers with me, and that I had nothing to fear in his district, at any rate.

I was informed by various other parties that if I once reached the Chaotung district I was safe, and that all the brigands were in the mountains near Yichehsün, two or three stages from Tungchwan.

I saw the mandarin several times, and he finally admitted he had only 60 soldiers

in the town, and that the rest, 120 of them, were fighting brigands near Lütién, not far from Chaotung. He agreed to give me 40 soldiers and again protested that there were no robbers in his district.

I sent a dispatch to the American consul at Yünnanfu, asking him to get the advice of the governor, but as the wires between Tungchwan and the capital had been cut by the brigands the message had to be forwarded through Kweichow Province, which took more than two days.

I sent word to the magistrate of Chaotung to have soldiers meet me at Yichehsün, but he agreed to order them only to the border of his jurisdiction.

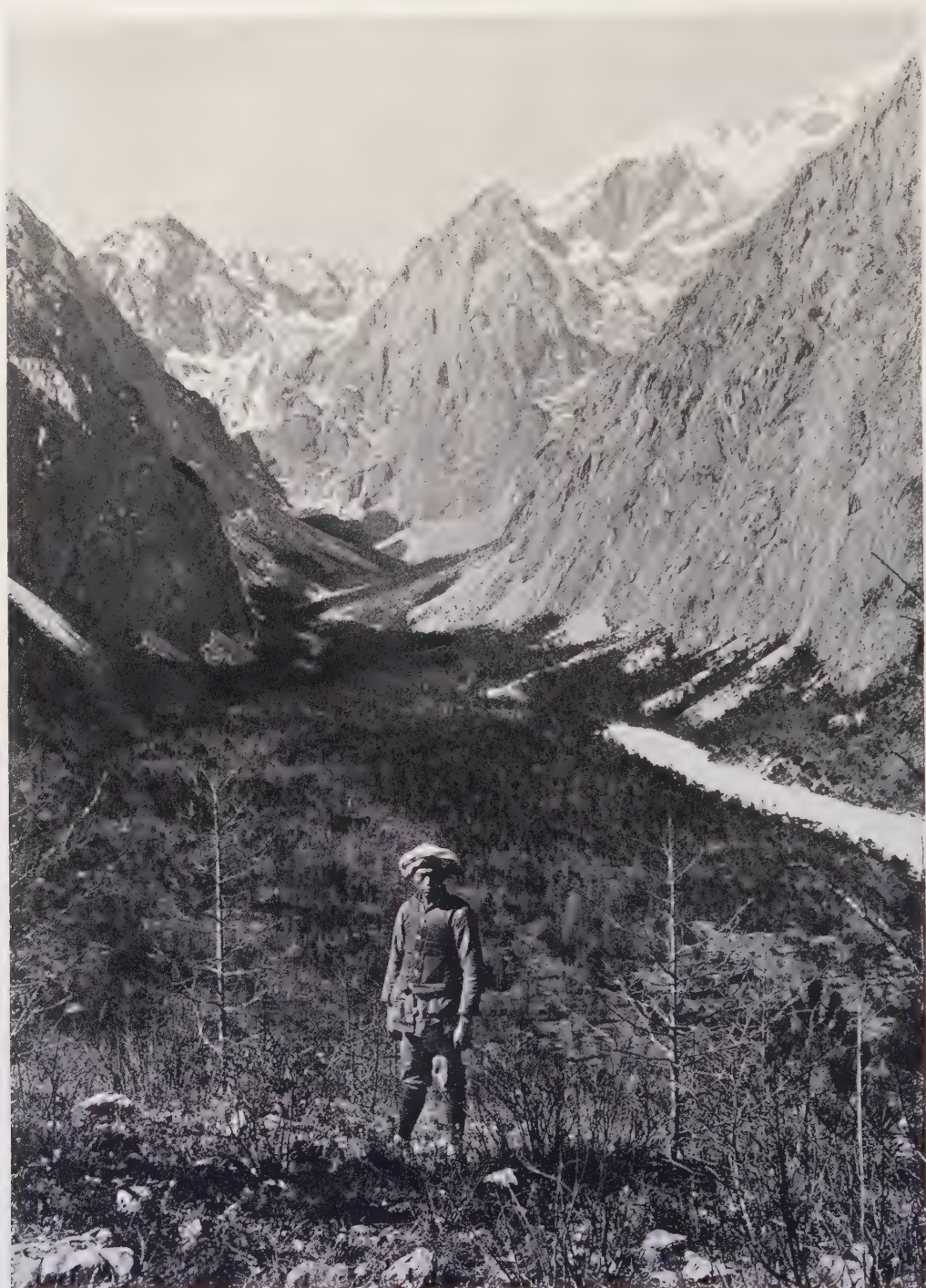
BRIGANDS ATTACK FROM THE REAR

With much misgiving I left Tungchwan. The first day passed without incident, but the second had much in store for us. After lunch under an old walnut tree, I made my way over the mountains with my 12 Nashi men, 26 mules, 40 soldiers, and all the followers who took advantage of the protection afforded by my guard.

We had not gone very far when my head muleteer reported that robbers were behind the caravan. I waited for the mules to catch up with us, and as they came in sight I rode on, but not for long, as my boys yelled in Chinese, "Robbers are coming," and at that moment the bandits began to shoot.

My soldiers behaved admirably, climbing to the ridge and opening fire on the brigands, but we soon found that we were considerably outnumbered. We pushed on as best we could over a pine-covered slope, down a deep ravine and up the other side, along a terribly rocky trail, the soldiers covering our retreat under the fire of the brigands.

* This informal narrative of experiences in the Far East has arrived as a letter written from Choni, Kansu Province of China, near the north-east border of Tibet, on May 17, a few days before the author set out upon his hazardous journey into the fastnesses of the Amne Machin Range. Dr. Rock, who was the leader of the National Geographic Society's expedition to Yünnan Province (see the NATIONAL GEOGRAPHIC MAGAZINE for April, 1925), is now collecting plants for the Arnold Arboretum of Massachusetts. He does not expect to return to America until the latter part of 1928.—THE EDITOR.



Photograph by Joseph F. Rock

THE AUTHOR'S NASHI PHOTOGRAPHIC ASSISTANT

The stream bed visible in this picture (Yünnan Province) is ordinarily dry, except during heavy downpours in the summer months, the water usually disappearing underground. The rocks in the stream bed are pure white limestone.

The shooting continued all afternoon, but, thanks to the bad marksmanship of the brigands, we lost only one soldier killed.

When we finally reached the small plain of Yichehsün, on the edge of which is the hamlet of Panpiengai, I thought we were safe. But the brigands followed us. They looted the little place, capturing three soldiers and their guns.

We eventually reached the village of Yichehsün, where we had to stop for the night.

Just as I arrived and passed through the dilapidated old gate (but no wall) there also came up 35 soldiers from Chaotung. They had first gone to Kiangti, but, as I had not appeared, they pushed on to Yichehsün. As I was talking with their officer, one of the Tungchwan soldiers came running into the village to tell me that a band of 200 robbers was only a mile and a half away.

The Chaotung soldiers went to help the Tungchwan soldiers, but soon all returned with the robbers at their heels.

CAMP IS ESTABLISHED IN COFFIN-FILLED TEMPLE

I was quartered in the center of the village in a miserable old temple full of coffins. The brigands came to within a half mile of the hamlet, where stood a large temple, and of this they took possession.

Darkness came on. At midnight the officers of the soldiers came in and announced that the brigands were outside and that the town could not be held against the impending attack. I never spent such a night in all my life.



THE FLAG WHICH PROTECTED THE AUTHOR FROM MOLESTATION
BY ONE GROUP OF BANDITS

This triangular bit of yellow cloth, on which Chinese characters are painted in alternate red and black, was presented by a brigand chief to Joseph F. Rock, who displayed it with excellent results from his tent pole while camped in a bandit-infested region in Yunnan Province. The legend reads: "Commander's flag; Temporary Station, American Agriculture, Forestry Department, Special Explorer." Unfortunately, Dr. Rock did not have this talisman on the journey which he describes here.

I opened my trunks and distributed \$600 in silver among my men, wrapped up some extra warm underwear, a towel, condensed milk and some chocolate, besides ammunition for my two .45-caliber revolvers.

Fully clad, I sat waiting for the turn of events. Every minute we expected the firing to commence. The soldiers said that they could protect me, but not my boxes, and that the safest move would be to retreat and try to find a hiding place if the brigands rushed the temple.

The natives of the village began burying their few valuables and great excitement ruled. It was a terrible wait and the longest of nights. Outside the hamlet heads of brigands that had been captured some days before were hanging from poles.

I was informed that several hundred bandits were surrounding the village and that capture was inevitable. At 4 a. m.



Drawn by C. E. Riddiford

A SKETCH MAP OF THE AUTHOR'S ROUTE

The trip described by Dr. Rock began at Tunghwan, north of Yunnanfu, and bore northward to Choni, from which base the explorer hopes to encircle the main peaks of the Amne Machin Range. He expects to return to Taichow in November or December.

our besiegers were still outside but no shot had been fired. At dawn there was not a bandit to be seen! They had vanished.

The people of Yichehsün begged me not to leave, saying that if I departed with the soldiers the robbers would come and burn the village the next night. I replied that I could not remain indefinitely, and that my presence was only an incentive for an attack. We had come to the conclusion that the people of Yichehsün intended to turn me and my caravan over to the brigands as a sort of peace offering on condition that the latter would leave the village alone.

As day broke the order to proceed was given.

The people said, "Oh, the bandits went ahead to a terrible mountain pass called Yakoutang and there they will intercept you!"

This I had feared myself, but, save for a rear attack by a band of robbers on that day's march, we reached Chaotung without further molestation.

The mandarin of Chaotung, in the meantime, having heard that I was surrounded by brigands, had immediately dispatched 250 soldiers to the rescue. They came too late to be of assistance; we met them one day out of Chaotung.

WOLVES RAID A GRAVE AT THE AUTHOR'S DOOR

In Chaotung I was ill, and also delayed by blizzards which lasted 11 days and made travel impossible.

I camped in an ancient temple outside the city walls. It was a lonely place, my only neighbors being the occupants of a few graves just beyond the temple walls. It was bitterly cold and I had to pitch my tent in the one long room in the temple proper among the idols; the roof was defective and the snow came through. It was, indeed, a miserable place. Charcoal was impossible to get, as the people from the outlying villages did not come in, owing to the heavy snow.

A few days before my arrival a burial had taken place near my temple, and there was a new grave just beyond the wall. One moonlight night wolves came to the temple door and howled for hours. I was afraid that they might jump over the low walls and attack us, but they contented themselves with digging up the newly buried man and devouring him. All we found the next morning were a few blue rags and the open coffin.

I was glad to resume my journey.

For days we waded through snow, and the mules had great difficulty going over narrow, icy trails which led through terrific canyons.

BRIGAND CHIEF PROVES TO BE IDEAL ESCORT

I had a peculiar military escort from Chaotung on. My soldiers were former bandits, whose chief, a famous brigand, had accepted employment with the Yunnan Government and undertook to escort parties through territory infested by robbers



THIS LITTLE PIG WENT TO MARKET: KIATING

Two men have carried it for many weary miles and, as the burden weighs 275 pounds, they are forced to stop and rest every 100 yards. They cannot put their load down, for it will scramble to its feet and run away; so they provide themselves with stout poles on which to rest it and themselves as well.



Photographs by Rev. Archibald G. Adams

A CHINESE MOLASSES-CANDY PULL: SZECHWAN

An assistant stands ready to catch the candy if it should fall while being draped over the hook.



Photograph by Joseph F. Rock

A PORTION OF THE AUTHOR'S CARAVAN AND SOLDIERS CROSSING THE FUKIANG RIVER IN NORTH SZECHWAN

Only half of the caravan and escort is visible in the photograph.

who were formerly members of his gang. Anyone accompanied by his men could rest assured that no one would attack him.

Often I was told: "To-day there are robbers on the road." Sometimes it was a band of as many as 80 bandits well armed, but my escort would say, "We will go ahead and arrange things with the robbers and then we will escort you through their district and you will have nothing to fear."

Thus I reached the Ta Kwan River, a tributary of the Yangtze, above Suifu. Here I chartered a boat, which brought us safely to Suifu. From there I went to Kiating and by river to Chengtu, the capital of Szechwan.

In Chengtu I was delayed by fighting to the north and also on account of illness. Governor Yang of Chengtu took the city of Mienchow five days north of the capital and drove out an independent general with 10,000 troops. The latter and his soldiers looted the city before they left, and the incoming soldiers of Governor Yang looted what remained. They even attacked the mission, and a missionary family—a Mr. Willistan and his wife and boy—was captured by bandits only 40 li (16 miles) from Mienchow. Traveling was very unsafe, as the defeated soldiers scattered into bands and turned highway robbers.

CAVALCADE IS A HALF MILE LONG

I left Chengtu with an escort of 140 regular soldiers and some cavalry. As we neared Mienchow the guard was increased to 190 soldiers, who marched with loaded rifles and fixed bayonets. Often, when I looked back from a hill, my train was over half a mile long, with a caravan of 26 mules, my helpers, 17 muleteers, and the soldiers. We were quite a formidable party (see illustration, page 336).

Many people joined my train for protection. However, in spite of my strong escort, we had to take a narrow and tortuous trail over mountains little frequented by travelers, as the main road to Mienchow was closed by a small army of brigands. Even the military did not dare take the shorter main road.

My escort was changed from town to town, and, as some of the places, like Hanchow, Tehyang, and Lokiang, were

"on the fence," so to speak, my soldiers from one community were not permitted to enter the next, for fear that they might fight and loot. Each group from the preceding town had to turn back at the city gates. Soldiers of the city at which we were arriving usually waited for me outside the gates and escorted me in.

We passed many dead soldiers on the road. Sometimes only the trunk was left, the head, hands, and feet having been chopped off. We also met many half-dead stragglers, who sooner or later joined their dead companions stark on the road.

IN THE GREATEST MEDICINE MARKET OF CHINA

From Mienchow I went to Chungpa, the greatest medicine mart of Szechwan, if not of all China. Here I found the Szechwan-Kansu border troops. Governor Yang had sent instructions that they see me safely to Pikow, the first large village in south Kansu.

The officer in charge of the border troops was very timid. He said he could escort me only as far as the Szechwan line, for last year the Kansu border troops and his men were fighting. Many villages were burned, and he was afraid that if his soldiers went to Pikow with me they would be disarmed by the Kansu soldiers and killed. I replied that as long as they were with me the soldiers would have nothing to fear, but he answered, "Yes; as long as we are with you, the Kansu troops will not dare do anything to us, but when we return alone, they will attack us."

A ROYAL RECEPTION IN KANSU PROVINCE

We went on to Chingchwan, the last town in Szechwan, and from there I sent a runner to Pikow with a letter to the officer in charge of the south Kansu border troops, asking him to give me an escort to Motzaping, the first village in Kansu, to which point the Szechwan troops were to accompany me.

Near the Szechwan border a few Kansu soldiers brought me the cards of two officers, who were waiting for me at Motzaping.

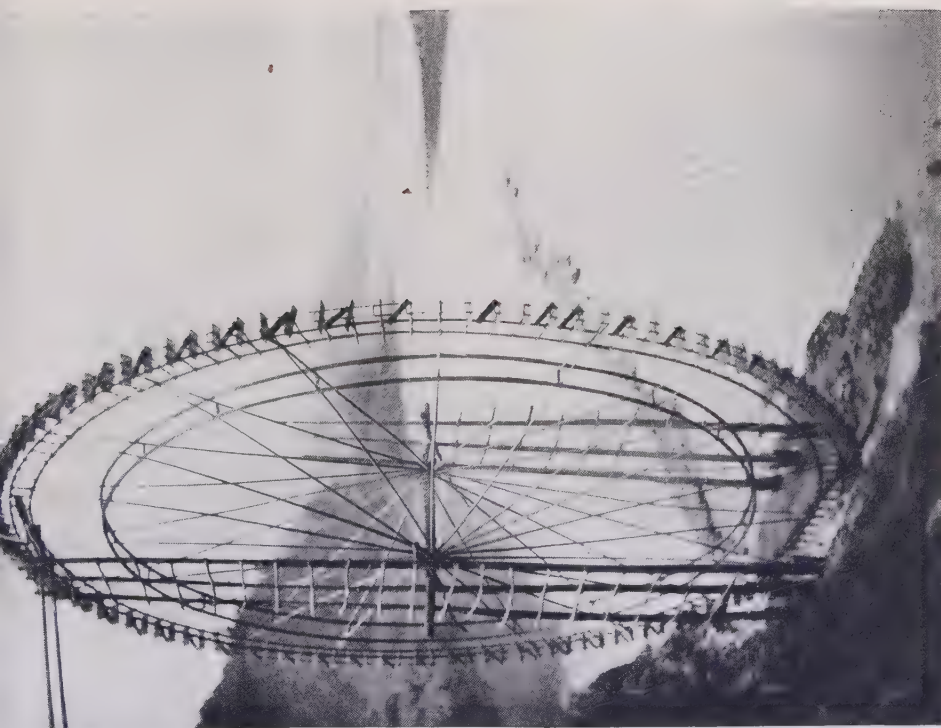
All was very amiable when the enemies met, the Szechwan soldiers and their officer turning me over to the Kansu



Photograph by S. R. Vinton

A BOAT SCENE NEAR CHENG TU, CAPITAL OF SZECHWAN PROVINCE

Chengtu, with a population of 400,000, is situated in the midst of a plain which is considered one of the "most highly productive and most thickly populated areas of its size on the surface of the globe." (See, also, "The Eden of the Flowery Republic," by Joseph Beech, in the NATIONAL GEOGRAPHIC MAGAZINE for November, 1920.)



Photographs by Rev. Archibald G. Adams

A SZECHWAN IRRIGATION WHEEL

These Ferris-wheel contrivances are frequently seen along the shores of shallow streams, when the banks are lined with farms. With the exception of the upright supports and the axle, this wheel, some 70 feet high, is constructed entirely of bamboo. Woven bamboo paddles on the rim catch the force of the rapid water in the mill race. Between the paddles are joints of bamboo, open at one end, which scoop up water and empty it into a trough of bamboo poles at the top, which conveys it to the rice fields, 50 or 60 feet above the river level.



THE GIANT HEAD OF BUDDHA AT KIATING, SZECHWAN

A "tea-money" tip was given the man who stands on the crown of the statue to provide a "yardstick" for comparison. Grass and ferns hide the carved curls of the head. Whitewash on the red sandstone gives the effect of a light, flesh-colored pink, weathered in patches. About once in ten years the face is gone over, scraped and repainted, by some devotee of the Buddha, which has been carved from a cliff that rises from the banks of the Min River opposite Kiating. The roofs of a temple can be seen to the left.



A STREET SCENE IN CHENG TU



Photographs by Rollin T. Chamberlin

THE MIN, A BRANCH OF THE YANGTZE, BELOW CHENG TU

In the foreground is the end of a soldier boat for transporting river guards.

troops and immediately returning to Szechwan, armed with a letter from me explaining their presence in Kansu territory, in case they were stopped by hostile soldiers.

The Kansu authorities have been exceedingly kind and courteous to me. In every town I have entered I have been given a royal reception, troops lining up, and band playing, the chief mandarins coming out with their red umbrellas, and mounted police often meeting me 20 miles out of a town and escorting me to tents which have been erected, where refreshments are served.

From Pikow to Kai-chow is five days' journey and from there to Minchow (not to be confused with Mien-chow of Szechwan) is seven days. In the latter city I stayed four days in a merchant guild where the officials had prepared excellent quarters for me.

Minchow is full of Mohammedans and many of them are robbers. I was warned to be careful and not to go out in the evening without a bodyguard of soldiers.

TWELVE MEN TO BE SHOT FOR ATTACK ON EXPLORER

The house in which I lodged was guarded day and night by 30 men, and yet on the second night Mohammedan robbers came and climbed upon the roof of the building, with the evident intention of overpowering my guard and robbing me.

The soldiers were on the alert, however; the ringleader and four men were



Photograph by Frederick R. Wulsin

CHONI TIBETANS BRINGING IN FUEL

The women wear gowns of cream-colored homespun and bright-red trousers.

captured. The prisoners were brought into the courtyard and bound to posts, where I interviewed them the next morning. The officials of Minchow were quite upset about this incident and strengthened the guard.

The captured men were taken in charge by the military, who beat them with bamboo until they confessed and gave the names of the others of the band and the whereabouts of their headquarters. The next day their stronghold, four miles from Minchow, was raided by soldiers and seven other robbers were brought in. They were all to be shot after I had left Minchow.



Photograph from Joseph F. Rock

THE PRINCE OF CHONI AND THE AUTHOR

During his stay in Choni, Dr. Rock lived in the prince's lamasery, in a quiet place with private courtyard. Below the spot where this photograph was taken 500 lamas pray from 4 a. m. to 2 p. m. They are ever busy with trumpets, conch shells, bells, and cymbals, which they accompany in a deep basso profundo.



Photograph by Frederick R. Wulsin

DEVIL, DANCERS IN COSTUME AT CHONI

From Minchow I went to Choni, a sort of independent territory ruled by a prince, a Tibetan chief (see illustration, p. 342). Here I learned that the best way to reach the Amne Machin Range was via Radja Gomba, on the Yellow (Hwang) River.

LIVING BUDDHA OF LABRANG IS IN EXILE

I asked the prince if he could help me to get to Radja Gomba, and he said the best way would be to see the Great Living Buddha of Labrang Monastery and ask his aid. The prince wrote to him personally and also gave me a letter of introduction. This Living Buddha, considered the third great incarnation, next to the Pantshen Lama of Tashi Lunpo, lives in exile.

The Mohammedan General Machi of Sining had taken Labrang some time previously, and recently had demanded 270,000 ounces of gold from this rich and most influential monastery; thereupon the Living Buddha left as a protest and is now wandering about from one monastery to another. At the present time he is in the Choni prince's territory, and I visited him at Ankurgomba, a small lamasery in the mountains near Taochow. He was exceedingly friendly and gave me a letter bearing his seal and addressed to the lamas of Radja Gomba monastery, demanding that they receive me well and escort me to the Amne Machin Range, making the tour around it.



Photograph by Joseph F. Rock

THE HOUSE IN WHICH THE AUTHOR STAYED AT A VILLAGE IN SOUTH KANSU

A crowd is listening to Dr. Rock's phonograph, which is playing the sextet from "Lucia." Soldiers are standing guard at the entrance to the house.



Photograph by Frederick R. Wulsin

TWO YOUNG LAMAS SHOWING HOW SIX-FOOT TRUMPETS ARE PLAYED: LABRANG

These trumpets play an important part in the services at Labrang, which is normally the seat of one of the three most powerful of the Great Living Buddhas. The town was recently captured by a Mohammedan general of Sining, however, and the Living Buddha is now in exile (see text, page 343).



Photograph by Frederick R. Wulsin

THE KITCHEN OF A RICH CHONI TIBETAN

Note the matchlock gun on the wall, the abundance of pewter and copper vessels, and the room's fine paneling.

It takes seven days to go around the Amne Machin peaks, and the Radja Gomba lamas are to arrange safe conduct with the Ngoloks of this region.

EXPEDITION TO AMNE MACHIN PEAKS IS ARRANGED

I stayed first in Taochow, then went to Hetso Gomba, a large but very unfriendly monastery in the Tibetan grass country, where I made purchases of sheepskin coats for my men, Tibetan boots, woolen caps, etc., for the coming cold.

From Hetso I returned to Choni to make final preparations.

If I had gone to Sining, I am sure General Machi would have stopped me. As it is, I arranged with the new Mohammedan sect at Old City Taochow to take me in to Radja Gomba.

This Mohammedan sect, called the New Sect, is a recent religious organization, at the head of which is a wealthy Moslem

who calls himself Jesus the Savior. His followers trade with the Tibetans of Radja Gomba and the Ngoloks of the Amne Machin. Their men go in twice a year with about 200 head of yak laden with salt, chili peppers, cotton cloth, trinkets of brass, brass kettles, etc., and bring out in return furs, musk, and other valuables from the Ngolok country.

These men bought for me 22 yaks and have allotted me five carriers and a headman, all of whom have been to Radja Gomba, which is 16 days from Taochow.

THE FIRST WHITE MAN TO VISIT AMNE MACHIN PEAKS

At Radja Gomba the Yellow River is crossed on inflated pigskins, and from there it is four days to the Amne Machin peaks.

So all arrangements have been made, and I am ready to start in about a week, not to emerge until next November.

Armed as I am with the valuable letter of the Living Buddha of Labrang, I think I shall have little difficulty in reaching my goal, the Amne Machin. There are, however, rumors about that the Tibetans are preparing to fight General Machi and that the Ngoloks are ready to join the Tibetans!

General Machi has been taxing the nomad Ngoloks for grass and water, so much for every head of cattle. This the independent Ngoloks refuse to pay, and there is a general revolt on. I only hope this will not interfere with my journey.

I have many photographs, some very interesting ones, and later on I hope to be able to write you an account of my trip to the famous peaks. I shall be the first white man ever to visit the Amne Machin and the first to cross the Yellow River at Radja.

MONEY IS UNKNOWN AMONG NGOLOKS

I have brought many trinkets for the Ngoloks, as money is an unknown quantity among them. Even at Taochow and west of Taochow silver dollars are not wanted, the conservative Tibetans still using lump silver.

I have supplied myself with several thousand taels of silver and a scale to weigh the pieces, a very primitive way of doing business. However, one must conform to the customs and habits of the people.

The money question is a very difficult one in this country. In Chengtu, for example, the silver dollar has 3,600 cash, in

Mienchow 3,700 cash, in Pikow 3,200 cash, in Minchow 2,600 cash, in Choni 2,200 cash, and in Hetso 1,800 cash.

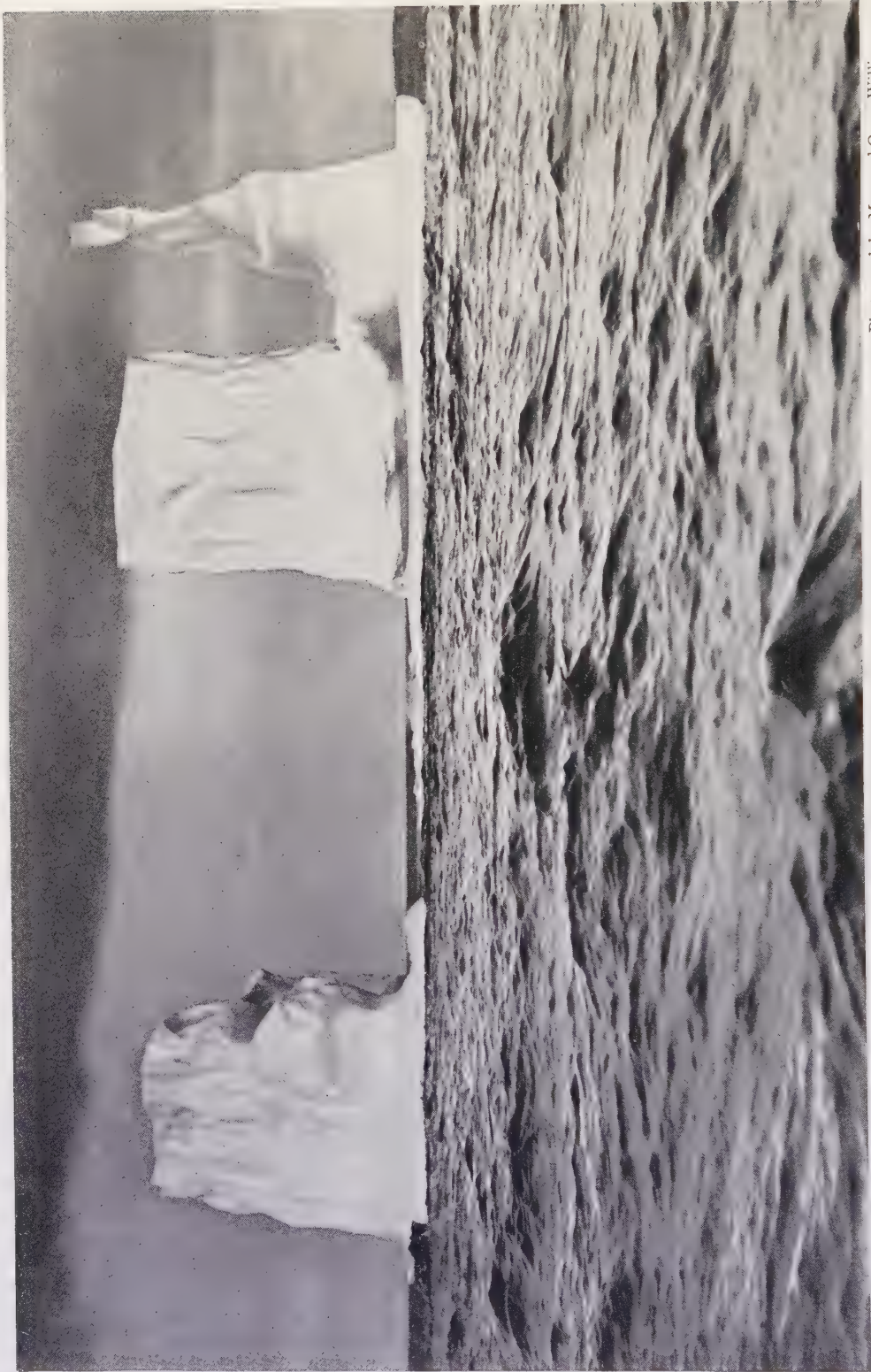
In Pikow the 100 and 200 cash copper pieces are taken, north of Pikow only the 100 cash pieces, and north of Kaichow only the 50 cash pieces, at Minchow only the 10 and 20 cash pieces made of copper and of brass, some yellow and some red! At Hetso they only take the red ones. Of the silver dollars, only the Yuan Shih-kai third-year dollars are accepted; those of the fourth to tenth year are refused, as they say Yuan Shih-kai died the third year, so there cannot be any tenth year of Yuan Shih-kai!

Szechwan and Hupeh dollars are not taken at all. There are several issues of Yuan Shih-kai dollars and some are a little lighter than others, and those are taken at a discount. If they have a tiny scratch on them they are refused, or else accepted at a discount of five to ten cents per dollar. As I said, west of Taochow only lump silver is taken. It is a real cross-word puzzle.

You will hear again from me when I shall have emerged from the Ngolok country. If you do not hear from me, well, then, it may be that I shall have found a final resting place in that land. This is my last word to you until November or December, when I hope to turn up again either at Taochow or Sining. My plan is next year to explore the Richthofen Range and then come out through Chinese Turkestan.

Once more, au revoir, not good-bye.

Notice of change of address of your GEOGRAPHIC MAGAZINE should be received in the office of the National Geographic Society by the first of the month to affect the following month's issue. For instance, if you desire the address changed for your November number, the Society should be notified of your new address not later than October first.



Photograph by Maynard Owen Williams

THE FIRST ICEBERGS ENCOUNTERED BY THE MACMILLAN ARCTIC EXPEDITION, OFF THE COAST OF LABRADOR

SCIENTIFIC ASPECTS OF THE MACMILLAN ARCTIC EXPEDITION

IT IS hoped that by the time this number of the NATIONAL GEOGRAPHIC MAGAZINE reaches the reader the major part of the program of the MacMillan Arctic Expedition, which took the field under the auspices of the National Geographic Society, the U. S. Navy co-operating, will have been accomplished.

However, pending the complete narrative of the expedition's work by the leader, Commander Donald B. MacMillan, which will appear in an early issue, it will be of interest to the members of the National Geographic Society, each of whom has had an equal share in financing the undertaking, to learn further details of the organization of the exploring party and its personnel.

The full roster of the expedition, which went north on the converted mine-layer *Peary* and the oil-burning yacht *Bowdoin*, is as follows:

ABOARD THE "BOWDOIN"

Donald B. MacMillan, in command of Expedition, Freeport, Maine.

Ralph P. Robinson, mate, Merrimac, Massachusetts.

John M. Jaynes, engineer, Somerville, Massachusetts.

Benjamin H. Rigg, magnetic observer, tides and currents, loaned by the U. S. Coast and Geodetic Survey, Burlington, New Jersey.

Maynard Owen Williams, staff correspondent, National Geographic Society, Washington, D. C.

John L. Reinartz, radio operator, Manchester, Connecticut.

Onnig Melkon, sailor and photographer, South Weymouth, Massachusetts.

Martin E. Vorce, cook, Somerville, Massachusetts.

Richard Salmon, sailor, Larchmont, New York.

Kennett Rawson, sailor, Chicago, Illinois.

ABOARD THE "PEARY"

NAVY PERSONNEL

Lieutenant Commander Richard E. Byrd, Jr., U. S. N., in command of Navy personnel.

Lieutenant Mienrod A. Schur, U. S. N., San Diego, California.

Chief Boatswain Earl E. Reber, U. S. N., Millville, New Jersey.

Andrew C. Nold, aviation pilot, U. S. N., South Bend, Indiana.

Floyd Bennet, aviation pilot, U. S. N., Waterbury, Vermont.

Nels P. Sorensen, aviation chief machinist's mate, U. S. N., Menominee, Michigan.

Albert Francis, chief aërographer, U. S. N., San Francisco, California.

Charles F. Rocheville, aviation machinist's mate, first class, U. S. N., Coronado, California.

E. F. McDonald, Jr., in command of *Peary* and in charge of radio, Chicago, Illinois.

George F. Steele, captain, Roxbury, Massachusetts.

Hosmer L. Freeman, mate, South Weymouth, Massachusetts.

W. D. Publicover, chief engineer, West Somerville, Massachusetts.

Dr. Walter N. Koelz, ichthyologist of the U. S. Bureau of Fisheries, Ann Arbor, Michigan.

Jacob Gayer, staff color photographer, National Geographic Society, Washington, D. C.

Dr. Leo M. Davidoff, surgeon, Peter Bent Brigham Hospital, Cambridge, Massachusetts.

P. D. Davidson, first assistant engineer, Portland, Maine.

Paul J. McGee, radio operator, Mattoon, Illinois.

Harold E. Gray, radio operator, Chicago, Illinois.

Edward MacNamara, seaman, East Boston, Massachusetts.

William Parker, fireman, New Orleans, Louisiana.

Henry King, seaman, Cambridge, Massachusetts.

Adolph Harloff, cook, East Boston, Massachusetts.

E. G. Freel, fireman, South Boston, Massachusetts.

Van R. Brown, fireman, Charlestown, Massachusetts.

John Kenney, messman, Rosindale, Massachusetts.

Rufus Sewall, officers' mess, Wiscasset, Maine.

John MacNamara, seaman, Everett, Massachusetts.

Ernest MacNamara, seaman, Boston, Massachusetts.

WIRELESS REPORTS INDICATE SUCCESSFUL SCIENTIFIC WORK

Wireless reports, which have been received at the headquarters of the National Geographic Society in Washington from the ship's base at Etah, Greenland, and which have been released to the newspapers daily, indicate that the scientific aspects of the expedition have been extremely fruitful, and it is believed that the technical experts are bringing back to the United States data in the form of field notes, natural history specimens, atmospheric and tidal observations, and natural-color photographs which will prove of ex-



Photograph by Maynard Owen Williams

LIEUTENANT RIGG INTERVIEWS A RESIDENT OF BATTLE HARBOR, LABRADOR

The *Peary* and the *Bowdoin* touched at Battle Harbor and at Hopedale, Labrador, the former vessel taking on coal at Hopedale before sailing for Godhavn, Greenland. The *Bowdoin* damaged her propeller and had to put back to Hopedale, where Commander MacMillan, crew, and scientists alike struggled feverishly for five days before a new propeller could be installed. After the yacht had been beached the entire cargo had to be shifted to the bow in order to tilt the stern upward sufficiently to make the repair at low tide. MacMillan, in a radio message describing the difficulties of the feat, added that his crew was composed of the finest men who had ever sailed north with him.

ceptional value in answering many hitherto moot questions as to the flora, the fauna, and the meteorology of Arctic regions.

The painstaking observations and the numerous specimens collected by Dr. Walter N. Koelz, loaned to the expedition by the U. S. Bureau of Fisheries and the University of Michigan, are expected to prove important additions to our knowl-

edge of the fishes and birds of the Arctic regions.

Dr. Koelz has been observing and collecting in a practically virgin field; for, with the exception of work done in Spitsbergen and a few random specimens collected incidentally from time to time by explorers, the Arctic fauna has not been concentrated upon by scientific observers in the past. Among the species studied by Dr. Koelz are several gulls about which nothing has been known hitherto. Information concerning Arctic hawks has also been entirely lacking and much is needed to fill out the life history of the blue goose.

In making his marine collections Dr. Koelz has depended largely upon gill nets with square meshes having open spaces about five-eighths and three-eighths of an inch across. Short lengths were spliced, making single nets up to 1,000 feet in length.

EQUIPMENT AND SUPPLIES CARRIED BY NATURALIST

Collecting fish, birds, and mammals in the Arctic is a difficult un-

dertaking, necessitating much equipment to provide against loss, so far removed from supplies.

Hundreds of pounds of special supplies and equipment were taken along, and problems of packing and transportation involved in getting the specimens safely back to the United States had to be worked out. Dr. Koelz took aboard the *Peary*



Photograph by Maynard Owen Williams

OUTPOSTS OF THE ARCTIC ICE OFF LABRADOR

the following: 15 gallons of formaldehyde, 20 gallons of alcohol, 100 pounds of salt, 2,000 feet of gill nets made of linen thread, trammel nets, dozens of thermometers, automatic water-sampling bottles, silk bolting cloth to seine up the almost microscopic food of the fish, dredges for creatures living on the sea bottom, insect nets, plant presses, and a number of copper tanks for use in preserving fish.

Because space was at a high premium on the *Bowdoin* and the *Peary*, there was much improvisation. After his fish were "pickled" in alcohol and formaldehyde, Dr. Koelz commandeered empty gasoline drums in which to bring the specimens back to the United States. The fish are preserved whole and will eventually repose in glass jars of alcohol.

The preservation of bird specimens is simple. The skins are split and slipped off with the feathers still in place. The neck is then severed, so that the head and skin remain. These are generously salted and, after drying, are packed away. Because they can be packed flat the bird skins take up little space. Hundreds of them have been stowed away in ordinary

wooden packing cases. Back home these skins will be softened by washing out the salt, will be stuffed with excelsior, and mounted, being thus restored to a lifelike appearance.

The skins of land animals have been dressed and numerous photographs are being brought back to aid taxidermists in devising lifelike mountings.

Experiments have been undertaken to determine the temperature of the water at various depths, and these fluctuations have been studied in relation to the zones of undersea life.

UPPER AIR TEMPERATURES CHARTED

Prior to the work of Commander MacMillan's party, upper air temperatures in the Far North were almost as little known as the secrets of the million-square-miles "blind spot" on the map. Summer records of these conditions not only will be of value to aviation in the future, but may have a direct bearing on weather forecasting.

Forecasting weather consists largely in detecting new disturbances as they show up on the western and northwestern borders of the United States, learning their



Photograph by Maynard Owen Williams

WHEN THE EXPEDITION WAS READY TO SAIL

On the bridge of the *Peary*, from left to right: Lieutenant Mienrod A. Schur, U. S. N., of San Diego, California; Mr. John Oliver LaGorce, Vice-President of the National Geographic Society, who accompanied the expedition to Wiscasset, Maine, to wish the party godspeed; Chief Boatswain Earl E. Reber, U. S. N., of Millville, New Jersey; and Commander Donald B. MacMillan, leader of the expedition. The Navy's personnel of eight is under the command of Lieutenant Commander Richard E. Byrd, Jr.

characteristics, and figuring out the paths they probably will follow because of prevailing barometric pressures and temperatures ahead of them.

The majority of what the weather forecasters call the "lows"—that is, the areas of subnormal barometric pressure—seem to originate over the warm sea south of the Aleutian Islands in the winter and over the interior of Alaska during the summer; but some of the conditions which cause these "lows" to be "built up" in those places and create "highs" to the

east have their birth farther north in the Polar regions, and a better knowledge of temperatures, pressure, and wind changes there will, it is hoped, facilitate weather forecasting.

In the search for the beginnings of its weather, the United States is not concerned with the entire Polar area, but chiefly with the region north of Alaska.

Most of the meteorological work has been done by Mr. Albert Francis, chief aërographer.

Temperatures, pressures, and wind con-



Photograph by Maynard Owen Williams

DR. GRENFELL AND MISS FERRIS, A GRADUATE NURSE IN CHARGE OF THE INTERNATIONAL GRENFELL HOSPITAL, AT FORTEAU BAY, WITH HER DOGS

Miss Ferris drives her own dog team and is so expert that she can outdistance most of the men. Since she inaugurated the custom of driving her team, the Labrador women have imitated her.

ditions—the vital weather factors—are not known in the regions north of Alaska to the Pole. Exploration of this area is preliminary to making detailed observations of these conditions, which directly affect farms and orchards of the United States.

Mr. Francis carried to the north on the *Peary* elaborate aërological equipment, consisting of wind measuring instruments for the winds in the upper air as well as for surface winds. These instruments were installed and placed in operation as soon as the expedition reached the ship's base at Etah.

Other equipment included instruments to measure the barometric pressure and atmospheric temperature and humidity at the surface and in the upper air. Numerous observations were taken daily and these were transmitted by radio to Washington whenever practicable so that they might be used in the preparation of the daily weather map issued at the Capital by the Weather Bureau.

It was Mr. Francis' main duty to take upper air observations before each flight made by the Navy planes, and conditions were studied to determine the kind of weather which probably would be encoun-

tered during each flight. Weather forecasts were prepared by the aërographer in so far as was practicable from the meager data available in Arctic Regions.

A special study has also been made of all unusual meteorological phenomena and photographs relating to these phenomena have been obtained in many instances.

All aërological observations have been carefully recorded and a journal has been written to assist in their interpretation. These data, it is hoped, will form the basis for an analytical study of Arctic conditions upon the return of the expedition.

Mr. Francis has also had charge of the Navy's photographic equipment.

COAST SURVEY REPRESENTATIVE STUDIES TIDES AND SOUNDINGS

Lieutenant Benjamin H. Rigg, loaned to the expedition by the United States Coast and Geodetic Survey, has carried on an important series of observations of tides, currents, water temperatures, and densities.

Tidal observations have been made at every point possible. At places where less than three days were spent the readings were made on a plain staff every hour, except near the times of high and low water, when readings were taken every five or ten minutes. Where a stop of three days or more was made, the readings were taken with a portable automatic tide gauge in connection with the plain staff.

Wherever practicable, bench marks were established in connection with the tide staffs, so that the planes of reference determined by these observations might be recovered at future times. Whenever possible, Lieutenant Rigg established three standard bench marks.

Current observations have also been made by means of a current pole about 15 feet in length, weighted with sufficient sheet lead to submerge all except one foot of it. A log line graded for 60-second run was used in connection with this pole,

the 60-second interval being determined by a stop watch.

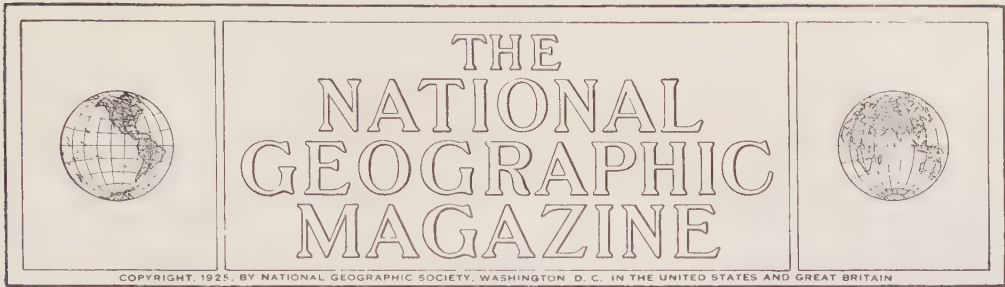
In many instances it was possible to make observations with the current pole every hour, and in addition observations were made half-hourly with a Price current meter at three depths—one-fifth, one-half, and four-fifths of the depth at each station, except that the lowest observation was not made below 80 feet. In most cases the observations began at the depth nearest the surface, and in every case the exact time of the observation was recorded.

Whenever practicable, temperatures and densities of the sea water have been taken twice a day—at 8 a. m. and 8 p. m. in most instances. Like the current observations, those of temperature and density have been made at three depths—one-fifth, one-half, and four-fifths of the depth of the station. These temperature observations have been made with a deep-sea thermometer in a reversible frame, and the water samples for density determination were secured with the Sigsbee specimen water bottle, the density being determined with a hydrometer in the usual way.

Lieutenant Rigg's equipment included a portable automatic tide gauge, complete with 20 feet of 3½-inch pipe; a plain staff 12 feet long; a stop watch; a log line, graduated for 60-second run; a Sigsbee specimen water bottle; two sets of hydrometers, a hydrometer jar, two deep-sea thermometers; a reversing frame for deep-sea thermometer; a water thermometer, and an air thermometer.

It is believed that Dr. Leo M. Davidoff, the surgeon of the expedition, will have much to contribute to its achievements from a scientific standpoint. His researches have been wide, for the general good health of the personnel has left him free to study many natural history specimens collected in the Arctic.

All in all, the members of the National Geographic Society may well feel gratified at the scientific data collected by the expedition which they have sponsored.



THE ROMANCE OF SCIENCE IN POLYNESIA

An Account of Five Years of Cruising Among the South Sea Islands

BY ROBERT CUSHMAN MURPHY

AUTHOR OF "SOUTH GEORGIA, AN OUTPOST OF THE ANTARCTIC," AND "THE MOST VALUABLE BIRD IN THE WORLD," IN THE NATIONAL GEOGRAPHIC MAGAZINE

With Illustrations from Photographs by Rollo H. Beck

TO numberless readers the flood of books and articles by war-weary sojourners in the southern Pacific has meant the discovery of a new literary field—one in which heavenly isles, green with the breadfruit and the hibiscus tree, ringed by sapphire lagoons and dancing surf, are the setting for the lives of languorous natives who retain the pristine charm of Adam and Eve.

Looking at the subject with a historic eye, however, it is illuminating to note that from the days of the early discoverers the lands and peoples of the Polynesian archipelagoes have periodically claimed the attention and excited the imagination of civilized mankind. The present tide of favor is only a recurrence, such as has taken place about once in every generation since 1760 or earlier.

In the beginning, the vital narratives of the great voyagers of the eighteenth century, such as James Cook in Britain and Bougainville in France, were read by practically all educated men of their day. That they exerted a profound effect is reflected in the prose, the poetry, the humane and religious zeal, the developing wanderlust, and even the social customs of the period.

About forty years after the death of Cook, or in the twenties of the nineteenth century, the activities of British non-conformist missionaries in the Society Islands, as described in William Ellis's "Polynesian Researches," once again focused the eyes of the world upon the ever-fascinating South Seas.

MELVILLE REVEALS CHARMS OF THE MARQUESANS IN "TYPEE"

Ellis's studies, one volume of which is a classic source book for first-hand records of Polynesian history, traits, and culture, passed through several editions. The memory of them had hardly faded, even from the popular mind, before the original "cannibal island thriller" appeared, in the form of Herman Melville's "Typee" (1846).

This work, which has recently shared in the general Melville revival, is a Yankee whaler's simple, personal account of four months' captivity among the then uncontaminated savages of the Marquesas Islands, the same people whom Captain Cook had long before called the finest race in the Pacific, for fair form and regular features "perhaps surpassing all other nations."



A WORKER IN THE TARO FIELDS OF RAPA

The taro has thick, tuberous roots and large heart-shaped leaves. The leaves are eaten as a sort of spinach, while the roots are used either like potatoes or in the form of *poi-poi*, which is made by boiling them, then grinding, and allowing the substance to ferment for a day or two. The result is a paste much esteemed by the natives.

"Typee" made Melville a literary lion the world over, and, although the book lacks the imaginative power of his whaling romance, "Moby Dick," it is, nevertheless, a tale which one can scarce lay aside unfinished. Moreover, the modern ethnologist does not hesitate to record the observations of its author with the same assurance that he would feel in quoting from a work of scientific scholarship.

Melville followed "Typee" with a sequel entitled "Omoo," dealing with the Society Group, and his success evidently spurred a host of lesser travelers, whalemens, and romancers to burst into print.

A considerable proportion of the books of the era were by British "globe-trotters," and, although these are of very irregular merit, they contain scattered kernels of priceless information.

The South Sea cult, if it may be so called, found its way even into literature for children. One famous, though long forgotten, example should be cited—Ballantyne's "Coral Island," published in 1858.

This is a book of the "Swiss Family Robinson" order, only much more so! It is excruciatingly melodramatic, with a pious moral on every page, and quaintly absurd in its geography, natural history, and ethnology. It reflects the influence of Ellis and Melville; but the penguins (which inhabit coral atolls!) the coconuts (which grow without husks!) and many other surprising flights of fancy must be credited entirely to Ballantyne's creative imagination.



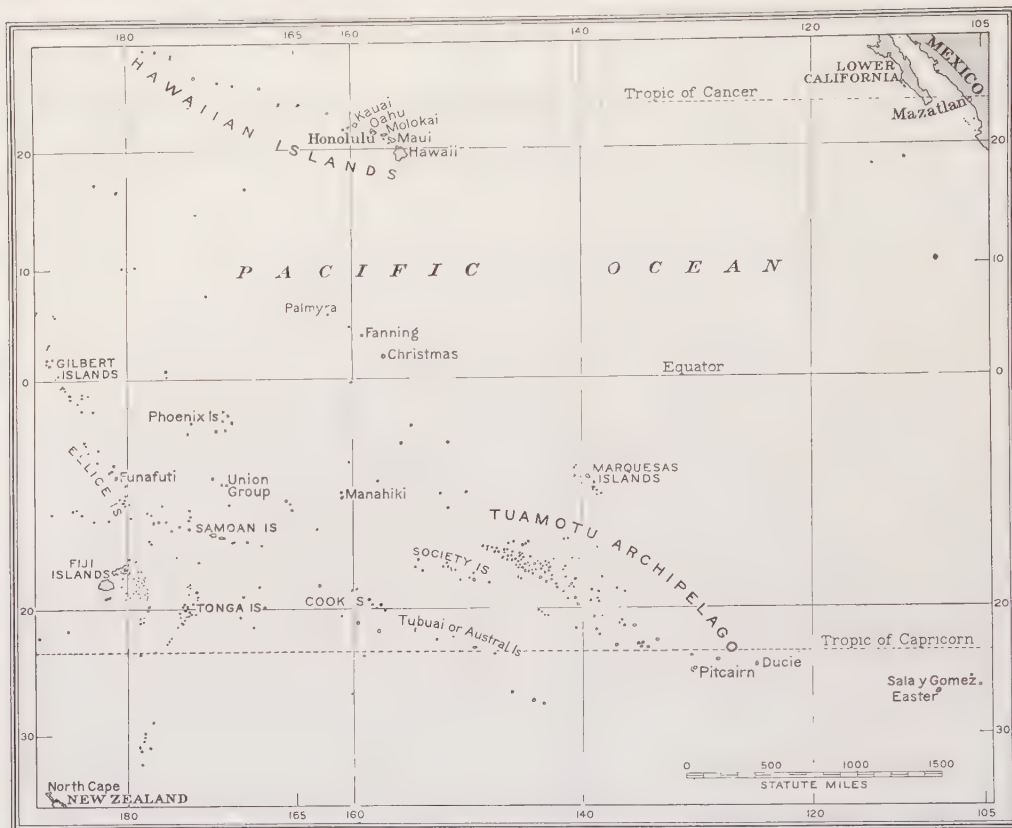
YOUTHFUL, COPRA WORKERS OF APATAKI ISLAND

A native boy shows how simply a coconut can be husked on a stake.

Pens continued busily throughout what might be termed the Melville epoch, but it remained for Robert Louis Stevenson to place once more the stamp of genius upon Pacific literature.

"In the South Seas" and other essays are, of course, beguiling and informing. Stevenson is at his best, however, when recording his pure impressions of the islands and their inhabitants; when he turns to moralizing or quasi-scientific speculation, he is usually wrong.

In the more recent exploitation and advertisement of Polynesia, literary men have had to share the honors with painters. The artistry of John La Farge and Paul Gauguin, for example, has had its part in the popular flare, no less than that



Drawn by James M. Darley

A SKETCH MAP OF THE ARCHIPELAGOES OF POLYNESIA

Polynesia ("Many Isles") comprises land areas of the Central Pacific Ocean lying within a rectangle bounded by the longitudes of 105° and 165° east, and latitudes 10° north and 30° south. (See, also, detail map of the Tuamotu, Marquesas, and Austral Islands, page 366.)

of Stevenson and Pierre Loti. Finally, the group of contemporary writers have found among the islands subjects which are always alluring and, to the bulk of readers, always new.

So much for a brief sketch of the popular history of the South Pacific, the object of which is to show that at more or less regular intervals someone has had the talent to "rediscover" Polynesia, and to put the region into the minds of multitudes.

THE GREAT TALES OF COOK AND OTHER VOYAGERS

It must be emphasized that most of the great tales have not been written within our own lifetime. The modern reader cannot afford, indeed, to neglect the wealth of information and the thrill of glorious adventure suggested by the

names of Quiros, Roggewein, Forster, Sir Joseph Banks, Bligh, Vancouver, Wallis, Krusenstern, Marchand, Carteret, G. A. Byron (grandfather of the poet), James Wilson, F. D. Bennett, Kotzebue, Wilkes, La Pérouse, Porter, Langsdorff, Darwin, Fitzroy, du Petit-Thouars, Garcia, Dumont d'Urville, Beechey, and Stewart.

If one would know the South Pacific in its day of barbaric splendor he must go back to the yellowed pages of Cook's "Voyages," to read Homeric descriptions of Tongan feasts, of pagan sacrifices, or of the maneuvers of the Tahitian canoe fleet, with its 7,760 fighting spearsmen, for the war against Moorea.

To turn from the present-day writers to James Cook is to feel

"like some watcher of the skies
When a new planet swims into his ken."



SEARCHING FOR THE MOUNTAIN BREEDING GROUNDS OF THE TAHITIAN PETREL.
Beyond the crest looms the Diadem, the loftiest of whose jutting spurs towers 4,000 feet above the sea.



MODERN POLYNESIANS

Fishing parties on the fringing reef of Tahiti, in the harbor of the port and capital, Papeete.



INSPECTING THE NEST OF A MINA BIRD
IN TAHITI

The white man brought the mina to the South Seas. He also introduced the weavers, hawks, rock pigeons, and Indian bulbuls.

The genius of the great voyager, the strength of his character, and his gift for critical observation stand out everywhere in his record. After a reader has followed him and lived with him through crowded years of his travels, the futile tragedy at Hawaii which ended his noble career comes as a dramatic, fateful blow, such as is rarely equaled in either history or fiction.

GEOGRAPHY OF POLYNESIA

In our consideration of the Polynesian archipelagoes, New Zealand may be disregarded because of its geographic affinity with the Australasian land masses. Hawaii, likewise, will be omitted, partly because of its remote location, north of the Equator and outside the field of the American Museum's contemporary investigations, and, more especially, because President Grosvenor, of the National Geographic Society, has recently published an admirable account of his Hawaiian studies and personal field work, which filled an entire number of the NATIONAL GEOGRAPHIC MAGAZINE.*

The typically "South Sea" islands, some of which stand alone while a larger number enter into clusters of considerable magnitude, include such important groups as the Society, Tuamotu, Marquesas, Austral, Samoa, Ellice, Phoenix, Union, Manihiki, and Tonga Islands. In general, they lie within a rectangle bounded by the longitudes of 105° and 165° east, and latitudes of 10° north and 30° south (see map, page 358).

The total number of islands is impracticable to estimate, for an atoll of a single name may in reality be composed of scores of separate islets. Brigham's "Index to the Islands of the Pacific" lists about 2,650 main bodies of land, after the elimination of synonyms applied by successive European discoverers.

The terrestrial area is in the neighborhood of 3,500 square miles, exclusive of Hawaii and New Zealand. The Societies, one of the larger groups, comprise about

* See "The Hawaiian Islands: America's Strongest Outpost of Defense—the Volcanic Floral Wonderland of the World," by Gilbert Grosvenor, LL. D., in the NATIONAL GEOGRAPHIC MAGAZINE for February, 1924.



A WORLD WAR MONUMENT AT PAPEETE, TAHITI

"Les Etablissements Français de l'Océanie à leurs Enfants Morts pour la France 1914-1918" is the inscription on this marble memorial.

637 square miles; the Marquesas, 490; and the Tuamotus, for all their "Cloud of Islands," which is the meaning of the original native name—80 islands and numberless fragments—sum up to but 364 square miles.

Politically, the Society, Marquesas, Tuamotu, and Austral islands have been French since the middle and latter parts of the last century. Many of the others are British colonial possessions, or are now under New Zealand mandate.

The United States has undisputed control over part of Samoa and less definite claims upon certain other islets. Easter Island and Sala-y-Gomez, the eastern outposts of the region, are Chilean.

For a clear record of the rather complicated status of post-war sovereignty, the reader is referred to the authoritative map of the Pacific, which was issued as a supplement to the NATIONAL GEOGRAPHIC MAGAZINE for December, 1921.

REEF-FORMING CORAL RESPONSIBLE FOR MANY ISLANDS

In the western South Pacific, as at Hawaii, volcanic phenomena are still in active progress, but, throughout the area with which we are here concerned, the earth-building fires have long been extinguished.

Disintegrating rock and erecting coral, separately or in combination, make up the



A PROFILE MAP OF TAHITI SHOWING THE ERODED VOLCANIC CORE, THE LAGOON, FRINGING REEF, AND BARRIER REEF

The main body of Tahiti consists of two high land masses connected by a low isthmus. The core of richly carpeted volcanic hills is surrounded by a coastal plain, which reaches a width of as much as a mile only at the mouths of the river valleys. Around the strand-belt are the fringing reefs, which extend, just awash or slightly submerged, into the lagoon moat (see text, page 363). Principles of geographical distribution are illustrated by land snails of the genus *Partula*.

structure of the innumerable dots in the wide sea, although more fundamental movements in the floor of the ocean basin itself have often compensated for the wasting tendency of the one or vitiated the constructive power of the other.

At certain islands the bottoms of the very bays in which the old-time explorers anchored have sunk or risen with the subsequent action of forces beneath the ocean.

The limits of the range of reef-forming corals in the central Pacific are roughly indicated by the parallels of 28° north and 30° south. But steep shores, and consequent absence of shallow coastal shelves, prevent the growth of reef-corals even within the favored area. The beetling Marquesas, with all but strandless shorelines, are, for example, without a girdle of reefs.

TAHITI IS EXAMPLE OF COMPOSITE VOLCANIC AND CORAL ISLAND

At Tahiti, as a type of the composite islands which attain the peak of Polynesian diversity and beauty, the core of worn and richly carpeted volcanic hills is surrounded by a coastal plain which reaches a width as great as a mile only in the mouths of the river valleys (see relief map on preceding page).

This encircling strand is a strip of great fertility, and is the only zone of such cultural plants as the coconut, sugar cane, banana, coffee, and vanilla. It was also the sole belt of permanent human habitation, even when the classic isle supported 150,000 aboriginal people, the estimate of Sir Joseph Banks in the late 18th century.

The strand overlies an ancient lava bench and portions of a buried fringing reef, although the surface soil, a product of crumbling uplands, has now in many places a thickness of nearly 20 feet.

Around the strand-belt, which here and there narrows until it disappears altogether, are the fringing reefs. These extend, just awash or slightly submerged, into the lagoon-moat. The latter is of varying breadth, and of a maximum depth of about 18 fathoms. It is in turn protected from the battering rollers of the open Pacific by the barrier reef, which is broken by numerous passes, especially opposite the outlets of streams where the

flow of fresh water tends to inhibit the growth of coral.

At most points the moat is broad and navigable, but at intervals it narrows to such an extent that the fringing and barrier reefs practically coalesce.

The main body of Tahiti comprises two high land masses connected by a low isthmus. The larger mass culminates in several sharp peaks, of which Orohena is credited with an altitude of 7,321 feet.

Both Tahiti proper and its smaller peninsula have been dissected through tremendous erosion, which has produced many valleys with almost vertical walls and knifelike dividing ridges.

These gorges are, in fact, so sharply marked off one from another by factors of altitude and plant zones that the respective populations of such creatures as sedentary insects and land snails are as completely isolated from each other as if they were on opposite sides of the world. Professor Henry E. Crampton has taken advantage of the circumstances which have converted the various valleys into natural laboratories of evolution, and has published a brilliant series of studies upon the astonishing geographic variation in one genus of land mollusks inhabiting this single island.

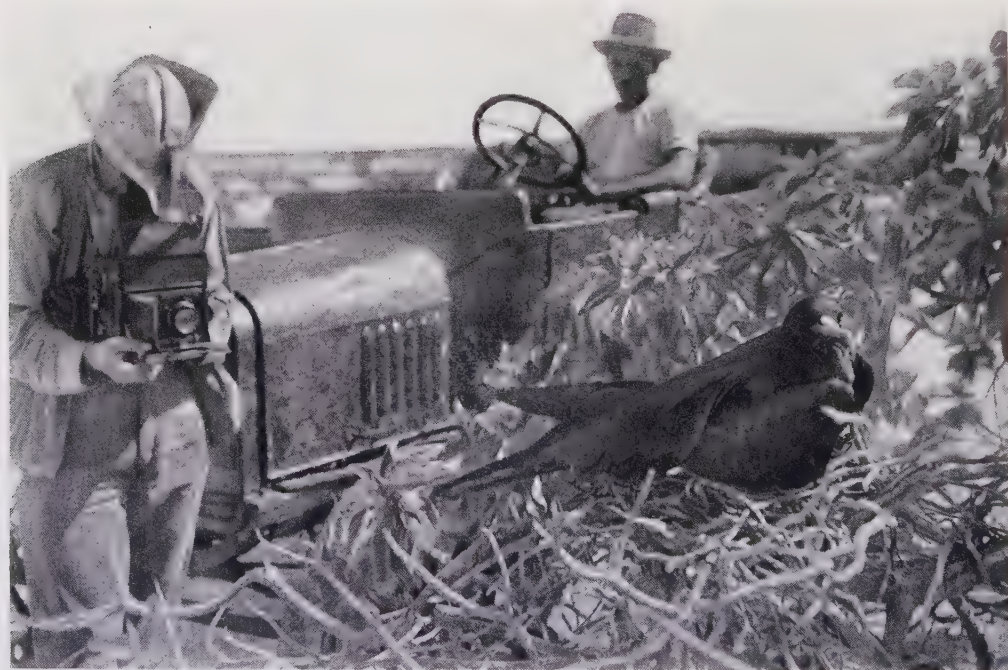
Turning to the atolls, or coral rings without a central pile of hills, we find that several large Pacific groups include islands of no other type. Atolls, however, are rarely in the form of the perfectly symmetrical, palm-lined "doughnuts" so quaintly portrayed in the woodcuts of old geographies. Most of them are highly irregular in outline and, moreover, the land which actually projects above the surface of the ocean is more often a chain of disconnected islets or *motus* than a ribbon of continuous beach.

The principal entrance to the lagoon is usually at the northwesterly or leeward end, for corals thrive best and build the strongest bulwarks on windward shores, or where the southeast trade wind heaps up the waters which bear their sustenance.

Hau Island, of the vast Tuamotu archipelago, may serve as a characteristic example of the low islands. It is thirty miles in length, seven in breadth across the widest part of the lagoon, with the longer axis parallel with the course of the



A TROPHY OF THE TROLLED LINE: A TUNNY CAUGHT NEAR CHRISTMAS ISLAND



BIRD STUDY DE LUXE

The naturalists of the Whitney Expedition enjoyed the use of P  re Rougier's American motor cars at Christmas Island (see text, page 402). The subject being photographed is a man-of-war bird. At the nesting time these birds are seemingly without fear.



THE SHARK HAS STRUCK

A familiar scene to one who has traversed the tropical ocean in a windjammer.

trades. The only entrance is at the leeward end (see page 369).

The long thread of the reef is elsewhere unbroken by navigable channels, but the "dry land" is made up of more than 100 distinct units, of which the longest has an extent of perhaps eight miles.

Since the greatest width of the islets nowhere equals a mile, it is clear that the coral-studded lagoon makes up 99 per cent or more of the entire area of the atoll. This explains why it is possible for vessels to sail into the lagoons of certain Pacific coral-rings and to anchor *out of sight of land* in the heart of glassy and sheltered waters.

In such friendly lagoons the primitive atoll-dweller plied his paddle, and on the quiet inner beach he built his villages.

The jagged spit behind his home was often a desolate and uninhabited waste, while the outer stretches, toward the booming sea, were, as Stevenson tells us, the abode of horrible specters among which the superstitious islander would hardly venture alone.

Here the rollers crashed as if they envied the peace within, and sought to destroy it; but the greater their volume and power, the more luxuriant became the soft, living coating of the limy breast-works.

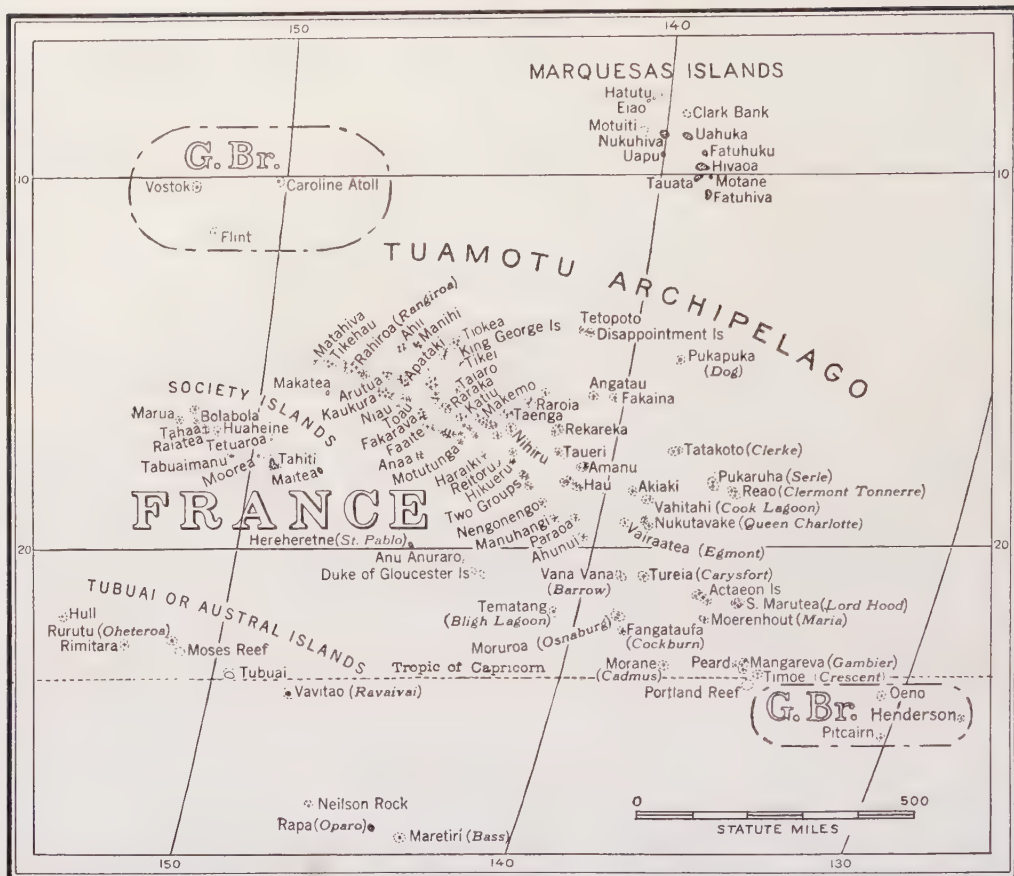
It is not difficult to comprehend that the seaward rim of an atoll, across which a hurricane might send an avalanche of water, should seem depressing to the Tuamotuan, whereas the native of such a lofty island as Nukuhiva could plunge joyfully into breakers which pounded his citadel in vain.

ORIGIN OF ATOLLS A SUBJECT OF FAMOUS CONTROVERSY

The scientific controversy regarding the origin of atolls is an old and famous one, and is not yet fully settled. Darwin held that the rings of coral, which sometimes rise from depths far below the limit at which reef-building polyps can live, are the result of the gradual wearing away or subsidence of a central land mass, accompanied by the equally slow upgrowth of the girdling reef.

According to this view, each atoll is in effect the barrier reef of an island which has vanished, or of a submarine mound which approaches the surface of the sea. More crudely stated, the atoll is the crown of a sinking volcano.

Sir John Murray, the botanist Guppy, and Professor Alexander Agassiz combatted this theory, and showed that reefs exist in parts of the Pacific where there



Drawn by A. H. Bumstead and James M. Darley

THE MARQUESAS, TUAMOTU, AND AUSTRAL ISLANDS (SEE, ALSO, MAP, PAGE 358)

The three main archipelagos belong to France, while the small groups to the northwest and the southeast are British possessions. The aggregate land area of the Marquesas group is less than 500 square miles; of the Tuamotu ("Cloud of Islands"), 364 square miles. This map is a detail from the National Geographic Society's "Map of the Islands of the Pacific," in colors, size 24 x 18 inches.

is no evidence of subsidence, but where, on the contrary, there has been uplift.

Borings made at the atoll of Funafuti, however, both through the ring itself and through the bottom of the enclosed lagoon, revealed the presence of coral rock to a depth of 1,114 feet.

Since reef corals cannot grow below 20 fathoms, the Funafuti experiment points to a progressive sinking of the ocean floor in this region, and confirms the older explanation. Many facts of zoological distribution in the Pacific make it difficult to avoid the same conclusion.

CLIMATE AND VEGETATION OF POLYNESIA

The final type of island to be mentioned is the secondarily upraised or tilted atoll,

which may present cliffs and hills of considerable altitude and of misleading superficial appearance.

The greater number of the Polynesian islands lie within the zone of the southeast trade wind, and enjoy a mild and equable climate, although many of the groups near the Equator are subject to hurricanes.

Rainfall is naturally most copious on the windward, or southeasterly, slopes of the high islands. In the Marquesas the difference is so pronounced that the principal islands have a heavily forested windward face, and a leeward, semi-desert side, where the vegetation and the fauna may be quite distinct.

In the same way, a high island often produces a "rain shadow" which more or



BASS ROCKS, SOUTHWARD FROM RAPA, THE LAST OUTPOSTS BETWEEN POLYNESIA
AND THE ANTARCTIC

"Here there is no place to land on from out of the gray water. For without are sharp crags,
and round them the wave roars surging, and sheer the smooth rock rises" (Homer).



AN UPLIFTED CORAL CLIFF OF RURUTU: AUSTRAL GROUP

In places this structure of submarine origin now rears 300 feet above the sea (see text, page 366).

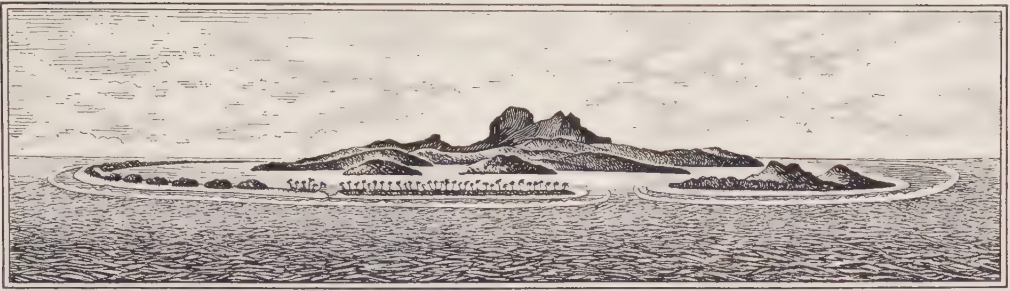


THE "FRANCE" BETWEEN BEETLING CLIFFS OF TAUATA ISLAND, MARQUESAS



THE ISLE OF FATUHIVA, MARQUESAS

In viewing this incredible little island from the sea, who would suspect that for ages its valleys harbored tribes that were sworn and bloodthirsty enemies? One shore was totally tabu, for example, to the hostile inhabitants of the other, beyond the mountains.



Drawn by William E. Belanske

THE TOPOGRAPHY OF A CORAL-RINGED VOLCANIC ISLE: PROFILE OF BOLABOLA, OF THE SOCIETY GROUP, AFTER ALEXANDER AGASSIZ

Below is Vavitao, of the Austral group, from a Hydrographic Office chart. These represent the type of Polynesian islands which attain the height of beauty and diversity. The drawings show the volcanic central mass, with weathered peaks, the thickly forested and more maturely weathered surrounding hills, the fringing reefs of the main body of land, the lagoon moat, and the inclosing barrier reef. The latter is partly awash, but is studded with higher islets, or *motus*, some of which support a rich growth of coconut palms and strand vegetation (see, also, relief map of Tahiti, page 362).

less thoroughly deprives its leeward neighbor of moisture, leading to considerable geographic diversity within small groups.

The Polynesian flora is pronouncedly Asiatic. The vegetation of the fertile volcanic islands is relatively rich; that of the coral islands scanty. Among the latter the coconut, pandanus, and mangrove

are almost the only conspicuous native trees.

In the high islands the more interesting forms of plant life, including all the species peculiar to the region, begin at an altitude of 1,000 feet or more above the sea. Orchids and ferns are abundant, the latter constituting fully 15 per cent of the total flora.



COFFEE PICKERS OF RAPA

These young women are not "posing," but were photographed unawares at their task.

At the Society Islands and elsewhere the indigenous valley forest is largely made up of tree ferns which descend well toward sea level in moist valleys, but not much below 1,500 feet on the drier coasts.

FEI, TARO, AND BREADFRUIT ARE IMPORTANT FOOD STAPLES

Features of the hillsides between 3,000 and 5,000 feet are the thickets of the fei, or Polynesian wild banana, an important source of food to-day as in prehistoric times (see page 385).

Another widely distributed staple, which, however, grows in the lowlands and is intensively cultivated, is the taro (see Color Plate IV), distantly related to our jack-in-the-pulpit. Both root and

leaves of this plant are edible after cooking has destroyed its acrid taste.

Still another important starchy food is supplied by the famous breadfruit, of which a score of varieties flourish among the Pacific islands.

The Marquesans of old practiced the laudable custom of planting breadfruit trees upon the birth of children, to insure the subsistence of their descendants. Owing to the dying out of the people and the lack of recent cultivation, the breadfruit is gradually disappearing over wide areas, for the seedless tree cannot compete unassisted with the more vigorous forest flora.

At such a long-settled island as Tahiti, a discerning visitor notes at once that



STRIPLINGS OF RIMITARA ISLAND, AUSTRAL GROUP, BOUND FOR SEA

enormous changes in the vegetation have occurred since the discovery. The transformation is most evident in the coastal plain, but even on the higher slopes many of the native plants have been driven out or upward by such interlopers as the guava and the tropical American lantana.

INTRODUCED PLANT PESTS RESPONSIBLE FOR SOUTH SEA "JUNGLES"

The rapid dissemination of the thorny lantana is due to the agency of another introduced form of life—the Indian starling, or "mina."

Writing of similar conditions in Hawaii, Brigham says: "The lantana (*L. camara*) was cultivated for years in gardens in the Hawaiian Islands, but it showed no tendency to spread until the so-called

mina (*Acridotheres tristis*) was introduced, when the berry became its favorite food and the indigestible seed was scattered everywhere."

Although the Polynesian islands were never lacking in areas of dense and tangled vegetation, it is the introduced plant-pests, rather than native flora, which are responsible for much of the impenetrable "jungle" found to-day.

In the higher, less affected places the steepness of the slope and the crumbling nature of the soil and rock contribute more toward the "inexplorable" conditions than the thickness of the vegetation.

The absence of poisonous plants on most of the islands and the paucity of native edible fruits are further characteristics of the Polynesian flora.



RAT-PROOF STOREHOUSES FOR COPRA IN THE LAGOON OF KAUHI

On some of the islets of the South Pacific, as at Tahiti, rats and mice were the only indigenous mammals found by white men. They have become a real pest, and the natives have devised water-bound storehouses for their harvested crops.

All the fruits which now abound in the gardens and orchards have been introduced since the time of the early discoverers.

RATS AND MICE WERE FORMERLY ONLY LAND MAMMALS OF POLYNESIA

Throughout the easterly Polynesian groups, rats and mice were the only native land mammals, and the ancestors of some of these may have been first brought into the region by early human migrants. One must go at least as far west as Samoa before even bats become an added element in the mammalian fauna.

Reptiles have only slightly better representation. Except for sea-snakes, there is none of the serpent kind in the long expanse between Samoa and the Galápagos Islands.

The clinging-footed geckos are the commonest of Polynesian reptiles, no less than eight genera occurring, together with half that many genera of the small lizards known as skinks.

Amphibians are practically wanting, for although a single species of toad inhabits Hawaii, we must make a long jump beyond the western limits of the region—to the Fiji and Solomon Islands—before we encounter frogs, salamanders, or another toad.

The birds of the South Sea Islands, both indigenous species and migrants, naturally exemplify a wide variety of marine and terrestrial forms and warrant special consideration in some future number of this magazine.*

MELVILLE ACCUSES REVENGEFUL WHALER OF INTRODUCING MOSQUITOES

The writer knows little about the insect population, except that the number and variety decrease as one progresses in an easterly direction from islands close to Australia and Malaysia.

As would be expected, the insect fauna of the coral Tuamotus is poor indeed when contrasted with that of the luxuriant forests of Melanesian isles. Biting flies are an annoyance at certain of the

Marquesas Islands and elsewhere, while mosquitoes, which doubtless include native species, are among the curses charged against the invading white man.

The tale of the alleged introduction of mosquitoes into Moorea, of the Society Islands, is related by Melville in "Omoo." It is quoted without warrant as to its accuracy:

"Some years previous a whaling captain, touching at an adjoining bay, got into difficulties with its inhabitants, and at last carried his complaint before one of the native tribunals; but receiving no satisfaction, and deeming himself aggrieved, he resolved upon taking signal revenge. One night, he towed a rotten old water-cask ashore, and left it in a neglected taro patch where the ground was warm and moist. Hence the mosquitoes."

FIRST HORSES AND GOATS ASTOUNDED NATIVES

The domestic animals which the primitive Polynesian navigators carried with them on their remarkable wanderings apparently comprised only poultry, dogs, and pigs. These have been so constantly augmented within the historic period that it is now difficult to tell what the original types were like. The modern chickens, for example, which are wild or feral on all the wooded islands, depart widely from the ancestral jungle fowl, and show the characters of many domestic strains.

Early in the last century Bennett noted that the hogs of the Marquesas "still exhibit, in great purity, the gaunt form, acute snout, arched back, high tail, pricked ears, and small deer-like feet, of the original Polynesian breed."

Razor-backed animals are still to be found, but even on small islands remote from the trade routes, one now sees many round, short-legged pigs of highly cultivated appearance.

The early travelers record amusing incidents of the amazement of the islanders when they first saw such monsters as horses and goats, and of their difficulties when they set themselves the Adam's task of naming them.

"To all the exotic quadrupeds," writes Bennett, "the Tahitians apply the generic names of their indigenous kinds, giving to the larger the name of *buaa*, or pig, and to

* See, also, "Bird Life Among Lava Rock and Coral Sand" (on the Leeward Islands of the Hawaiian Group), by Dr. Alexander Wetmore, in the NATIONAL GEOGRAPHIC MAGAZINE for July, 1925.



COCONUTS READY TO BE CONVERTED INTO COPRA

The sun-dried meat of the coconut is the chief article of commerce of the South Seas. It is estimated that 1,000 full-size nuts will yield approximately 500 pounds of copra, from which 25 gallons of oil can be obtained.



DRYING COPRA AT MANGAREVA

In addition to its use in soaps and the manufacture of candles, coconut oil is now successfully utilized in the manufacture of oleomargarine.



DRYING COPRA ON TUREIA ISLAND

The coconut crop is not only profitable, but it requires no labor in cultivation and comparatively little effort in harvesting.

the smaller that of *uri*, the dog, or *iore*, the rat. The ox they name *buaa-toro*, or pig with a long neck; the horse, *buaa-horo-fenua*, or pig that runs quickly over the ground; the goat, *buaa-niho*, pig with teeth (horns) on its head. . . . The monkey, of which some examples have been taken to their shores, they call *uri-taata*, the man-dog; and the cat, *iore-pii-fare*, the rat that climbs the house."

ABORIGINAL, POLYNESIANS A TALL, HANDSOME PEOPLE

Most of the islands which can strictly be called Polynesian are, or formerly were, inhabited by a rather tall and handsome aboriginal people, representing a mixed race, but very distinct from the dark-skinned and frizzly-haired Australasian natives.

In the literature of Polynesia no branch of knowledge is so obscured by uncertainty and confusion as that concerning the origin, relationships, and migrations

of the people. Their entrance into the oceanic islands has been traced back indefinitely, to about the first century of the Christian era.

Dr. E. S. C. Handy has recently concluded from genealogical evidence that such a remote group of islands as the Marquesas may have been settled in the tenth century.

The racial status of the Polynesians is, if possible, even more complex a subject than that of their tenure of the numerous archipelagoes.

Earlier students not only emphasized their uniformity in culture and language, but also pointed to them as an example of striking uniformity of physical type, extending over a widely varying environment. They are described as being almost identical in appearance from Hawaii to New Zealand and from Samoa to Rapanui (Easter Island).

A great deal of sheer speculation, and no little nonsense, has been written about



A COPRA-LADEN SLOOP IN THE LAGOON CHANNEL OF MANIHI, TUAMOTU ARCHIPELAGO, WITH THE "FRANCE" IN THE BACKGROUND



BRAIDING HOUSE WALLS FROM PALM FRONDS: KAUEHI ISLAND, TUAMOTUS

In addition to the copra of commerce, the coconut palm supplies the South Sea native with one of his chief articles of food, a refreshing drink, an intoxicating beverage, timber and thatch material for his dwelling, water vessels, and fiber for ropes.



A MARQUESAN WOMAN WOOD-CARVER OF HANAVAVE VALLEY, FATUHIVA ISLAND

this subject. It is only within the last few years that the investigations of trained anthropologists have begun to solve the problems.

The late Dr. Louis R. Sullivan, Associate Curator of Anthropology in the American Museum of Natural History, says of racial types in Polynesia:

"The now rapidly accumulating data on the biology of the inhabitants of the Pacific islands are beginning to indicate clearly that the 'Polynesians' are in no sense to be considered a uniform racial type. The 'Polynesian type' is, in fact, an abstract concept, into the make-up of which have entered the characteristics of several varying physical types.

"Anthropologists have long disagreed on the racial affinities of the Polynesians. Some have classified them as Mongols, others as Caucasians; while still others have maintained that they are a special race. This in itself is strong evidence that the Polynesians are a badly mixed people, for, whenever there has been a general disagreement as to the racial affinities of any group, it has been found almost invariably that the group was non-homogeneous.

"There is much vagueness as to what

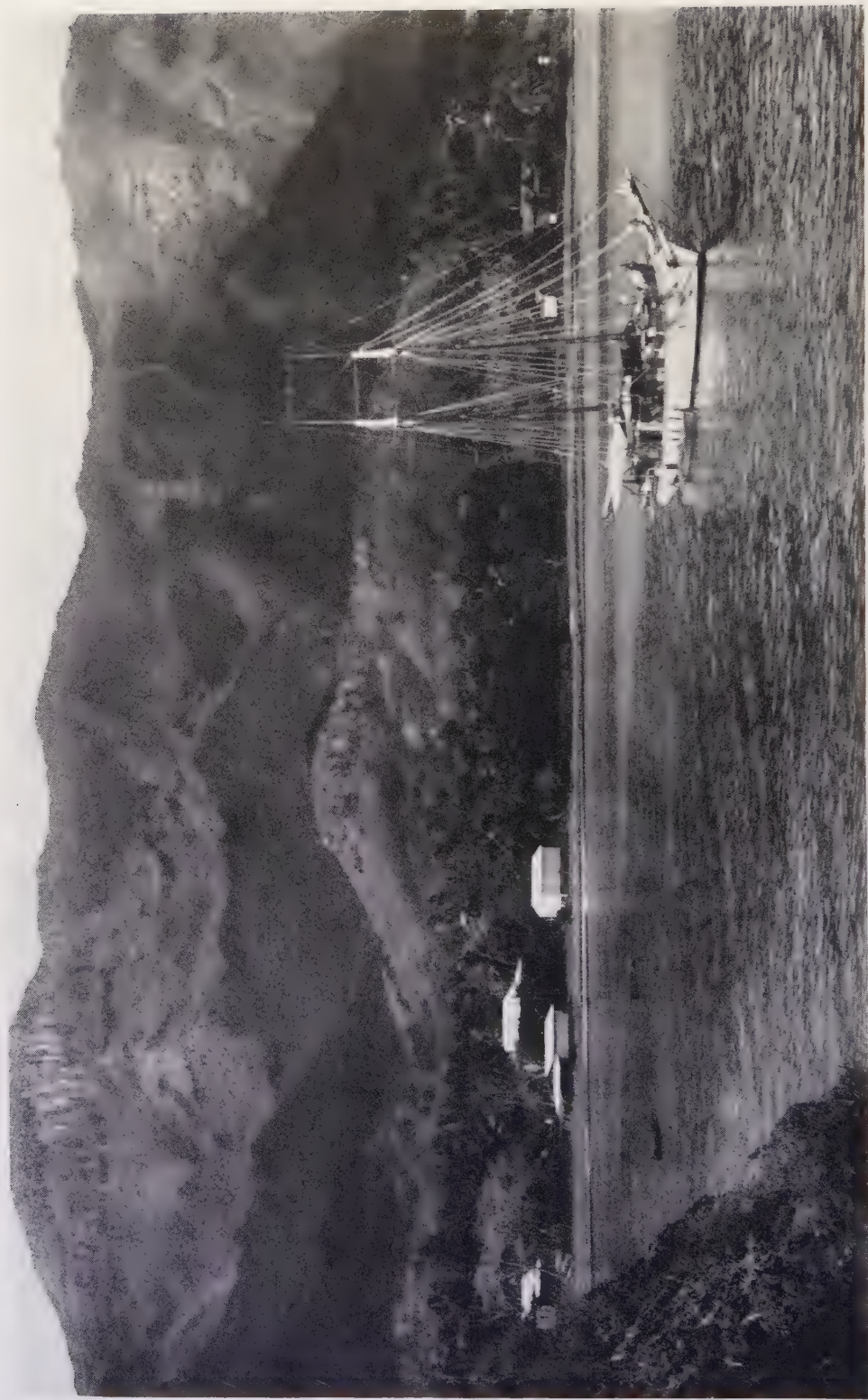
constitutes a Polynesian, but as generally conceived and described, he is a tall and remarkably well proportioned type, with a short head, a high and relatively narrow nose, straight or slightly wavy black hair, and a yellowish brown skin.

"In no part of Polynesia from which we have information does this type make up the entire population at the present time. There is strong evidence that in times past, and not so very long past either, this element was entirely absent, or not present in any appreciable strength."

ISLAND WOMEN IMPRESSED EARLY VOYAGERS AS PARAGONS OF BEAUTY

According to Dr. Sullivan, the racial affinity of the Pacific islanders with ourselves is not nearly as close as the romancers assume.

It is undeniable, however, that temperamentally as well as physically the Polynesians seem to share an extraordinary number of traits with people of European stock. The apparent resemblances, together with the charm of their idyllic islands, have combined to endow them with a peculiarly strong attraction for the white men who have come among them during more than two centuries.



A QUIET ANCHORAGE OFF NUKUHIIVA ISLAND

Fourteen miles in length and ten miles wide, Nukuihiva is the principal island of the Marquesas group. There are three safe harbors on the southern side.



SPIRES OF NUKUHIVA ISLAND FROM HATHEU BAY

Stevenson has described the vale and bay of Hatihau as inclosed on three sides by a bowl of mountains, while on the fourth the rampart has been bombarded into ruins. "The interior of this vessel is crowded with lovely and valuable trees---orange, breadfruit, mummy-apple, cocoa, the island chestnut---and for weeds, the pine (pandanus) and the banana. Four perennial streams water and keep it green; and along the dell, first of one, then of another, of these, the road, for a considerable distance, descends into this fortunate valley."



YOUNG TARO AT RAPA

In southern Polynesia the starchy root of this water-growing plant replaces the equatorial breadfruit as the basis of poi-poi.

As regards the famed personal attractiveness of the Polynesian women, due allowance must, of course, be made for an almost entirely subjective factor in the early records—the enthusiastic state of mind of European or American seafarers who had been cooped up with companions of only their own sex during voyages many months in length.

The island women would naturally seem paragons of beauty, moreover, to voyagers who had touched *en route* at the Strait of Magellan or at primitive African or Australian havens.

The relative leisure in which most of the women spent their lives, their distinctly “feminine” natures as judged by European standards, and their locally broad and independent views concerning the distribution of their favors, all had effect in creating an impression which has grown into a fetish.

Native ideas of sexual morality were, as a matter of fact, by no means uniform; a reader of Cook, or of any of the other early navigators, will find abundant evidence that originally the freedom observed at certain groups of islands was

balanced by rigid ideas of chastity at others.

From Tahiti, and still more from the Marquesas, the tradition of beauty coupled with almost total lack of restriction seems to have pervaded the world. The propaganda, if it may be so called, dates back to Quiros and has been carried on by Cook, Marchand, Krusenstern, Porter, and a host of later travelers, as well as, indirectly, by missionaries and others who could regard no part of the condition without abhorrence.

And yet not one of the early writers gained an inkling of the real significance of native customs which departed from the ethics or the social code of Europe!

The whalers who visited the Marquesas mainly to take part in debauchery, returned home filled with pious condemnation. More godly sojourners attributed the whole state of affairs entirely to the zeal of the devil.

Krusenstern explains the depravity of young Marquesan women as due to the cupidity of the men of their families, who sought by vicarious means to obtain iron or other useful material from the white



RAPA GIRLS BOUND FOR THE TARO FIELDS

At the right is the end of the white church of Ahurei Bay. The members of the expedition presented a case of kerosene for the mariner's light on this church, and were rewarded by a deluge of gifts from the hospitable islanders (see text, page 425).



MATRONS OF RAPA POUNDING TARO ROOTS, AS THE FIRST STAGE IN THE
MANUFACTURE OF POIPOI

The natives of Rapa, as shown by both physical characteristics and their dialect of the Polynesian language, are more akin to the primitive inhabitants of the New Zealand region than to those of the Society Islands.



A DAMSEL OF RAPA WITH A BURDEN OF TARO ROOTS, WHICH SHE HAS CARRIED A MILE ACROSS THE MOUNTAINOUS RIDGES

men. Stevenson, with even greater error, regarded the misdeeds which he records as chiefly a new development resulting from recent degeneration of the inhabitants.

WHITE MAN BROUGHT A PANDORA'S BOX OF TROUBLE TO MARQUESANS

It has remained for modern ethnologists, working without mental bias among the sad remnant of the Marquesans, to demonstrate that the native customs can not justly be summed up and dismissed as mere depravity.

The obvious answer to such a charge is that the ancient code worked too well—that it enabled the inhabitants of the islands to develop through long centuries

into a splendid type of savage, who exhibited in marked degree virtues which are a necessary requisite of happy, successful family and tribal existence.

Marriage among the Marquesans, for example, was characterized by quite as much loyalty and affection as among any other primitive people, even though (or perhaps because) the wedded state came rather as an end than as a beginning in the intimate relationships of men and women.

The manner of life, whatever its abstract ethical status, was eminently practical during the period of isolation. With the coming of the white man, however, a Pandora's box of predatory and destructive influences was opened, and the Mar-



A LAD OF RAPA IN HIS TARO-LADEN OUTRIGGER

In a region of amphibious people, the men of Rapa are particularly noted as boatmen (see text, page 425). Of old they were favored as recruits for the Yankee whaling vessels, with the result that to-day there is a preponderance of women in this island's population.

quesans were wiped out before they had received much encouragement to alter their ways.

Readers who are familiar with the sorely misinterpreted record of Polynesian vices owe it to themselves to round out their information by referring to Dr. Handy's admirable study of "The Native Culture in the Marquesas."

A LOYAL, GENEROUS, FRIENDLY, AND
IMAGINATIVE PEOPLE

Dr. Handy stresses the democracy and truthfulness of the Marquesans, and attributes to them "loyalty, generosity, and gratitude in friendly personal relationship; a keen appreciation of individual integrity expressed in personal independence with clear conceptions of justice and honor; high refinements, subtleties, and graces in social and æsthetic expression; and capacity for rational and imaginative thought belonging to a very high order of intelligence."

Of such kind were the Pacific people who were among the first to melt away after ships had moored in their roadsteads. "The tribe of Hapaa," wrote Stevenson, "is said to have numbered some 400, when the smallpox came and

reduced them by one-fourth. Six months later a woman developed tubercular consumption; and the disease spread like a fire about the valley, and in less than a year two survivors, a man and a woman, fled from that new-created solitude."

MARQUESANS ARE GRADUALLY
DISAPPEARING

To-day the inhabitants of the once populous Marquesas number about 1,800, including a handful of whites and many Chinese mixed-bloods.*

The story is characteristic, for, while the Samoans and certain other islanders have fared better, occasional pestilences, to which they are in nowise inured, still carry away large proportions of the population.

From the days of discovery the Polynesians have been subject to every disintegrating evil. The altruism of a few pioneer missionaries has been unable permanently to stay them.

* See, also, "A Vanishing People of the South Seas: The Tragic Fate of the Marquesan Cannibals, Noted for Their Warlike Courage and Physical Beauty," by John W. Church, in the NATIONAL GEOGRAPHIC MAGAZINE for October, 1919.



TUMANU, AN OLD WARRIOR OF TUREIA ISLAND,
TUAMOTU GROUP

His canoe, on the beach of the lagoon, is joined with sennit in the ancient Polynesian manner. The canoes of the Tuamotuans were of such superior make in the old days that the primitive Tahitians dignified them with the name of *pahi*, a term applied only to their own war canoes and to the ships of the white men.

One of the most successful evangelical ventures in the South Seas was that of the early British mission at the Society Islands.

Ellis's record of the years of devoted labor without visible sign of response, and then of the sudden tumbling of the pagan régime as if by divine fiat, makes dramatic reading even for one not interested in the special cause. Whole families, communities, and tribes at Tahiti and the neighboring islands suddenly expressed a desire to become Christian. Within a matter of days or weeks, the old order

toppled like a house of cards.

The temperament of the Polynesians seems to be well adapted to acceptance of a literal, one might say a primitive, type of Christianity.

At Pitcairn Island, and in a very few other localities where extraneous influences have not yet obliterated it, the simple and fervent religious life, naïve and unashamed, recalls descriptions of the church in patriarchal times.

THE WHITNEY SOUTH SEA EXPEDITION

The preceding brief account of the history of discovery in Polynesia, and of the profound changes which are still taking place, points to the importance of further scientific investigation.

Opportunities now existing must be seized within the span of the present generation or they will slip away irrevocably. This is the reason for the intensive activity of the Bishop Museum, of Honolulu, in many branches of Pacific re-

search, as well as for the contemporary work of the American Museum of Natural History.

Five years ago, Mr. Harry Payne Whitney agreed to support for the American Museum a notable project in the Pacific. The choice of a leader in the field was fixed by virtue of former accomplishments upon Mr. Rollo H. Beck, a veteran exploring naturalist who had previously served on expeditions in South American waters and elsewhere. Thus the Whitney South Sea Expedition was launched.

After a reconnaissance of Tahiti and of

several adjacent parts of Polynesia, Mr. Beck purchased the auxiliary schooner *France*, a step which made the expedition independent of sailing schedules and trade routes.

The *France* has since visited more than 100 islands of the Society, Marquesas, Tuamotu, Austral, Cook, Samoan, and Fiji groups.

Collection and study of the birds of the South Seas have been the primary objects (see text, page 394), but many other animals and plant specimens have also been obtained. Photographs illustrating the environment, the animal life, and the appearance and customs of the human inhabitants, have been taken. Especially valuable are the camera's records of those localities—regrettably numerous—in which the state of the fauna and of the people is still altering materially in response to external transformations.

Some idea of the extraordinary industrial activity occasionally undertaken in even the most out-of-the-way islands may be gained from a description of a pearl-diving season.

AMONG THE PEARL DIVERS

The opening of this great event in the French colonies comes in July. Since diving is not permitted during successive years at the same island, all gear, stocks of merchandise, and building material must be taken to new islands in annual rotation—no small undertaking when it is remembered that a coral atoll which normally supports perhaps 200 persons,



A MAN OF MOOREA, SOCIETY ISLANDS

This stalwart native is carrying two bunches of fei, or mountain bananas, and his fighting cock. Heavy loads of fei are carried down many miles from the upland forests.

may become during the diving season the abiding place of thousands.

The following quotation is from a recent press account:

"This year the open island is Hikueru, one of the Tuamotus, 400 miles to the eastward of Tahiti. Already this lonely atoll is taking on a metropolitan appearance. The profits to be gained come not only from the pearl-shell won from the lagoon, but from the sale of all kinds of wares dear to the native heart and from the providing of entertainment to refresh the weary diver and his women folk after the labors of the day are over.

"The average native diver wins a good



A DANCING GIRL OF TAKAROA

The Manchester cotton prints have long since replaced the native tapa, or bark cloth.

sum from the bottom of the lagoon and much of it goes on expensive silk dresses for his wife and daughters, on the delectable canned goods of the *popaa* (white man) and on the movies.

"This year there are to be, it is said, three moving picture theaters, any number of motor cars for hire—the length of the roadway in Hikueru is less than a half mile, but that apparently makes no difference—a brass band, and, it is reported, electric lights along the Great White Way of this little ring of coral sand.

"Late advices indicate that the season this year at Hikueru will be the most active in many years. It is estimated there will be at least 1,000 divers at the island. These, together with their families and the traders with their staffs, will swell the population of the island during the season to nearly 4,000."

The effects of such concentration upon the breeding birds and other forms of indigenous life are easy to imagine!

After the preliminary field work at Tahiti, in 1920-21, Mr. Beck and his companions sailed northward to Christmas



THE CALL TO SUNDAY SCHOOL, FAAITE ISLAND, TUAMOTU GROUP

A cotton jacket over the pareu (see Color Plate VI) and a straw hat make up this lad's Sabbath attire.



YOUTHFUL FISHERMEN OF RURUTU ISLAND, AUSTRAL GROUP

The children of Polynesia have always been treated with great tenderness. The early missionaries, who looked at nearly every custom askance, recognized the primitive islands as a children's paradise. Destruction of new-born infants was, to be sure, extensively practiced in the Society Islands and elsewhere, but this evil had its root in overpopulation and periodical food shortage.



FATHER AND SONS ON THE MARQUESAN ISLAND OF TAUATA

The Marquesas Archipelago has long been famed for the fine physique of its people. The wearing of wreaths, and of flowers in the ears, is a widespread custom in Polynesia.

Island, where Père Rougier operates great coconut plantations.

Then the *France* made the first of three visits to the romantic Marquesas. Then far southward among the Austral Islands, removed somewhat from the blight of civilization, and on to lonely Rapa, the "Uttermost Thule" of the Pacific, renowned for peerless sailors and interminable hospitality (see pages 419-425).

Next, eastward to isolated Pitcairn, where the descendants of Commodore Bligh's seamen, who fled into oblivion after the notorious *Bounty* mutiny of 1790, were found happy, law-abiding, and

devout, suffering not at all for the stormy sins of the fathers (see, also, page 392).

After reaching her easternmost goal at Ducie Island, the *France* turned again toward Tahiti by way of the thickly strewn Tuamotus, sending ashore her boats at every rock or palm-green strand.

FOLLOWING THE "FRANCE"

While we cannot keep in the wake of the *France* within the brief scope of this article, we can skip about among the Polynesian isles by drawing upon the voluminous notes of Mr. Beck and his comrades, Messrs. Ernest H. Quayle and

José G. Correia, recording some of their impressions and comparing these with experiences of earlier pioneers.

Upon landing in Tahiti, the members of the expedition arranged with two native guides for a trip into the interior. On the morning of October 11, they left Papeete by motor, a pleasant ten-mile ride along the western coast of the island, to the mouth of the Punaruu River, where the guides were to join them.

Minas were calling loudly from the tops of the taller trees; terns were sailing over the smooth lagoon, and migrant shore birds whistling on the beach; while the steady boom of breakers on the barrier reef offshore was mingled with the rustling of near-by coconut fronds.

Interspersed with neglected palm groves were little patches of finely cultivated ground where Chinese gardeners, the inheritors of Polynesia, raised in rigidly straight rows the various vegetables for which they found a market in Papeete.

When the car reached the Punaruu River, the luggage was soon transferred into four sacks which were swung on poles borne on the stalwart shoulders of the islanders. The latter then led the way along the trail which wound into the gorge of the Punaruu. At its mouth this canyon was half a mile in width, but it narrowed rapidly to 100 yards, with precipitous walls on either side.

Three miles from the entrance the party came upon a small tract where an industrious native had cleared off a bit of



LITTLE MAIDENS OF TAUATA ISLAND

The sweet Marquesan smile has captivated all visitors from the early days of Pacific discovery.

the steep, rocky hillside, and had planted it with papaya trees which were laden with green fruit.

Wading back and forth across the stream as one side or the other seemed to offer the smoothest trail, the travelers after three hours turned out of the main gorge and picked their way along a rivulet that trickled down between yet narrower walls. Stopping by a shady pool, Tafia, the head guide, dropped his burden and pointed up the left cliff to indicate the route.

A faint trail led skyward, so, after a leisurely lunch, they began the thousand-foot climb, finally surmounting the precipice near a group of welcome coconut

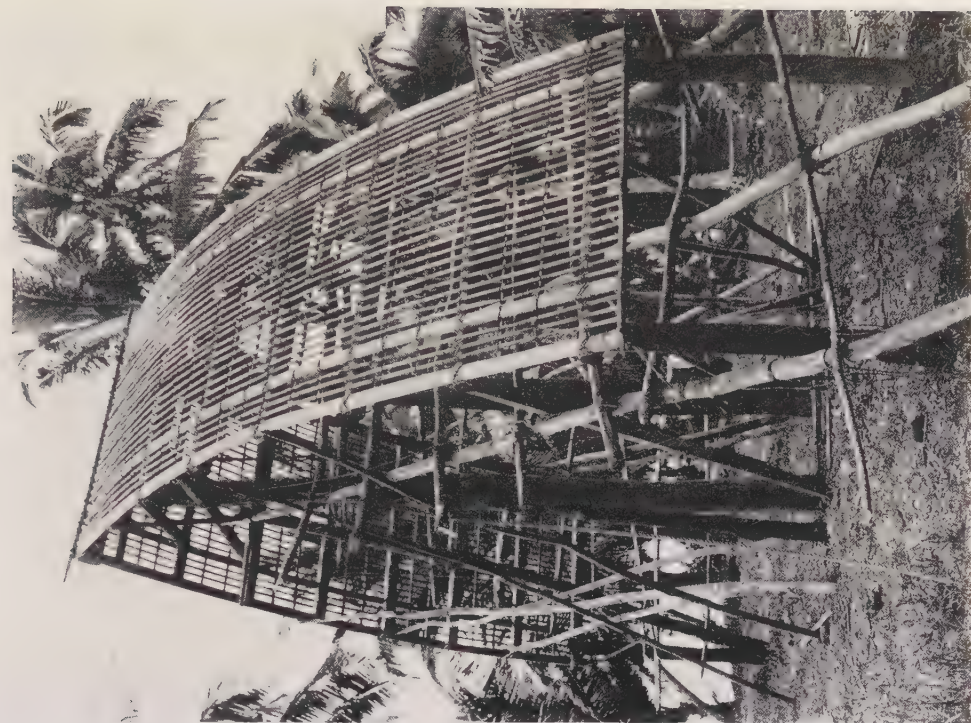


COOLIES AT WORK IN THE PHOSPHATE BEDS OF MAKATEA
In some of the Pacific Islands, notably Christmas, phosphate has been quarried to a depth of 100 feet.



POLYNESIAN MASONS

They are rebuilding with coral blocks the wall of the church on Tureia Island. The mortar trenches suggest small canoes.



A STAGE IN THE ERECTION OF A SAMOAN RESIDENCE,
ISLAND OF OLOSENGA



A FISHING CANOE OF AMERICAN SAMOA, WITH SHELLS
DECORATING PROW AND STERN



MEN OF PITCAIRN, AHoy!

The male population of one of the most romantic spots on earth is seen coming out to visit the *France*. The treasured whaleboat could have come from nowhere on earth but Buzzards Bay.



A RESIDENCE OF PITCAIRN, THE VERITABLE PROSPERO'S ISLE OF THE
"BOUNTY" MUTINEERS

Pitcairn was discovered by Carteret on July 2, 1767, but the foundation of its fame dates from Bligh's famous voyage in the *Bounty*, 20 years later. The mutiny is one of the most blood-stirring and most often told romances of the sea. The present inhabitants are descendants of the mutineers. They are of mixed blood, but in appearance the Caucasian features predominate. They are notable in Polynesia for virtue, piety, supreme contentment with their island home, and for a simple, patriarchal type of Christianity.

palms. After a draught of fresh coconut milk and a few minutes' rest, they started forward again through the gloomy forest, emerging at a grassy depression where a few golden plovers, recent arrivals from far-off Alaska, were resting about the borders of a small pond.

A mile beyond the pond they halted beside a brook for the night. The scarcity of birds during the first day was attributed by Mr. Beck to the rain which had fallen in frequent showers.

A PIG IS COOKED IN TAHITIAN STYLE

The next morning was bright and hot, so it was decided to hunt for the day in the vicinity of camp.

Tafia accompanied Mr. and Mrs. Beck toward the foot of towering cliffs which bounded the plateau to the eastward. Before reaching the base of the cliffs, they began to note roughly built stone walls which supported terraces of earth against the hillside. Dozens of these structures were observed during the course of the day.

An occasional cooing dove or chattering kingfisher was heard though seldom seen in the tall trees which reared above the lower tangle of brush. Game seemed scarce, but while the naturalists were enjoying some juicy oranges at the base of the tree out of which the guide had dropped them, a wild pig was attracted to the spot by the thud of falling fruit. Hastily slipping a heavy charge into his fowling piece, Mr. Beck added the unlucky porker to the larder.

Tafia, all smiles, at once began to break up twigs and branches, and, after piling them carefully together, fired the heap. Next he inclosed the flames with chunks of lava and, as the fire began to burn well, piled on still more rocks. Within ten minutes conditions seemed to be to his liking, so he took the pig and pulled it rhythmically back and forth over the heated stones.

In a short time clear patches appeared on the scratched surface; a little more rubbing, and a few deft pulls with his fingers under the legs and about the ears, completed the depilating process. It was astonishing to watch a dirty, bristly, brindle pig become a clean, smooth, white-skinned carcass.



THE SCHOONER "FRANCE" LUFFING TO PICK UP THE COLLECTOR OF SEA BIRDS

Within less than half an hour from the time the victim had walked to its fate, Tafia was carrying the bristleless body campward.

After this exhibition of Tafia's skill, he was instructed to cook the animal in the ancestral Tahitian manner.

The meat was accordingly cut into convenient pieces and thoroughly washed in the brook. Then it was placed on a thick layer of green leaves above a pile of rocks which had been heating for some time. Another layer of leaves was laid over the meat, and the whole covered with stones.

CATS ACCUSED OF DESTROYING BIRDS OF TAHITI

When supper-time came the appetizing food was removed. After the choicest parts had been eaten, the remainder was cut from the bones, and rammed into three large, green bamboo segments. These were laid on the still hot stones, covered once more with leaves, and taken out next morning, deliciously cooked, to furnish all with meat rations for the next three days.

Thus, by employing the principle of the fireless cooker, do the Polynesians pre-



A HUNGRY CHICK: NESTLING MAN-OF-WAR BIRD OF MARIA ISLAND: TUAMOTUS

pare dishes which for economy and tooth-someness cannot be excelled.

The next camp, built against a great overhanging rock and well roofed with the leaves of a mountain tuber, was not altogether proof against the tropical downpour that assailed the party during the first night beneath it.

First in one place and then in another, the dripping wetness would strike through; a shift of position would be made, and then a wait for the next leak.

The little brook, 20 feet below, which had been dropping in tiny rapids and cascades from one shallow pool to another, changed its placid murmur to a lusty rumble as it rolled stones along its bed and carried down the heavy volume of

water from the reeking watershed.

A sunny morning dried the moisture on the foliage, but the search for birds was again disappointing. Two or three Tahitian crag-swallows flying back and forth in the dark shade of orange trees, a pair of noisy kingfishers pursuing insects instead of perching above the water with an eye for finny prey, and companies of the boisterous, introduced minas, comprised the species seen.

The negligible number of native birds in so seemingly favorable an environment was new in Mr. Beck's experience. One could hardly believe that the rats, which are such a pest in the lower parts of the island, had destroyed the nests of the native birds while permitting the imported minas and weaver-finches to increase.

It seems more likely that cats, running wild for a century, may have exterminated several of the ground-living species which were formerly found in these mountains.

As the guides had assured Mr. Beck that they knew where shearwaters nested close under the cliffs of the highest peaks, the journey inland and upward was continued. The trail led past well laden orange and lemon trees, beneath which were thick tracks of the wild hogs.

Camp was made near the famous Diadem (see page 359), and here, at an altitude of 2,700 feet, the roof was shingled with the great leaves of the fei, the plants of which grew by hundreds all about.

Few ripe clusters of these wild bananas were observed, for native carriers had



A RESTING MAN-OF-WAR BIRD OF DUCIE ISLAND



DIVESTING A TROPIC BIRD OF ITS DECORATIVE RED PLUMES WHILE IT STICKS TIGHT
TO ITS EGG

This bird can neither perch nor stand up. It nests on the ground and must shuffle away on its breast before taking flight. The long, red tail plumes of this tireless flier (see Color Plate XII) have always been prized ornaments of the South Sea people. Islets where the birds nested in good-sized communities were formerly monopolized by Polynesian rulers as sources of wealth.



A LARGE MOUTHFUL

A Tuamotuan purple-crowned fruit pigeon accepting a berry from the captain of the *France*.

recently visited the groves and had trundled the weighty bunches down a 10-mile trail to the coast, where they could be marketed at about 10 francs apiece.

A VAST PLATFORM WHERE CEREMONIAL DANCES WERE ONCE HELD

A two days' hunt in nearly unscalable mountain country, where the rope was more than once necessary for the safety of the climbers, revealed only a few deserted burrows of the hoped-for ocean birds.

Leaving the camp near the Diadem, they hiked down a sharp ridge, penetrating a canyon which opened into the main watercourse from Mont Orohena, highest peak of the Society Islands.

Following down the brawling stream, they soon reached a rockbound waterfall, and it became necessary to scale the straight bank and scramble over the spur that descended between converging rivers.

Atop the spur was a vast square platform of hewn rock, formerly the scene of ceremonial dances and other impressive pagan rites. A more inaccessible site, under present-day conditions, would be hard to imagine, but when the coast below teemed with human inhabitants it may have been otherwise.

A few more days of camping and hunting among the thick ferns and bamboo brakes of the lower upland basins, and the party returned to the mouth of the Puna-ruu. To ornithologists the trip was not



MAN-OF-WAR BIRDS PERCHED HIGH ABOVE THE SHIMMERING PACIFIC: EIAO
ISLAND, MARQUESAS

During the mating season the male man-of-war, or frigate, bird wears an inflatable sack of flame-red at his throat, a sort of toy balloon, with which he lures the female bird to the nesting site which he has chosen. (See, also, "Bird Life Among Lava Rock and Coral Sand," in the NATIONAL GEOGRAPHIC MAGAZINE for July, 1925.)



RED-FOOTED BOOBIES AND THEIR NESTS: HATUTU ISLAND, MARQUESAS

Two members of the booby family, the brown- and the blue-faced, lay their eggs on the ground, but the red-footed species, like the man-of-war bird, nests in trees.

highly satisfactory, but to those who appreciate the incomparable mountain loveliness of "la Suisse Tahitienne" it left nothing to be desired.

EXPLORING A SOUTH PACIFIC ISLAND IN A FORD

In January, 1921, Messrs. Beck and Quayle made the voyage to Christmas Island, north of the Equator, where, in sharp contrast with the Tahitian field work, they conducted their hunting in a Ford!

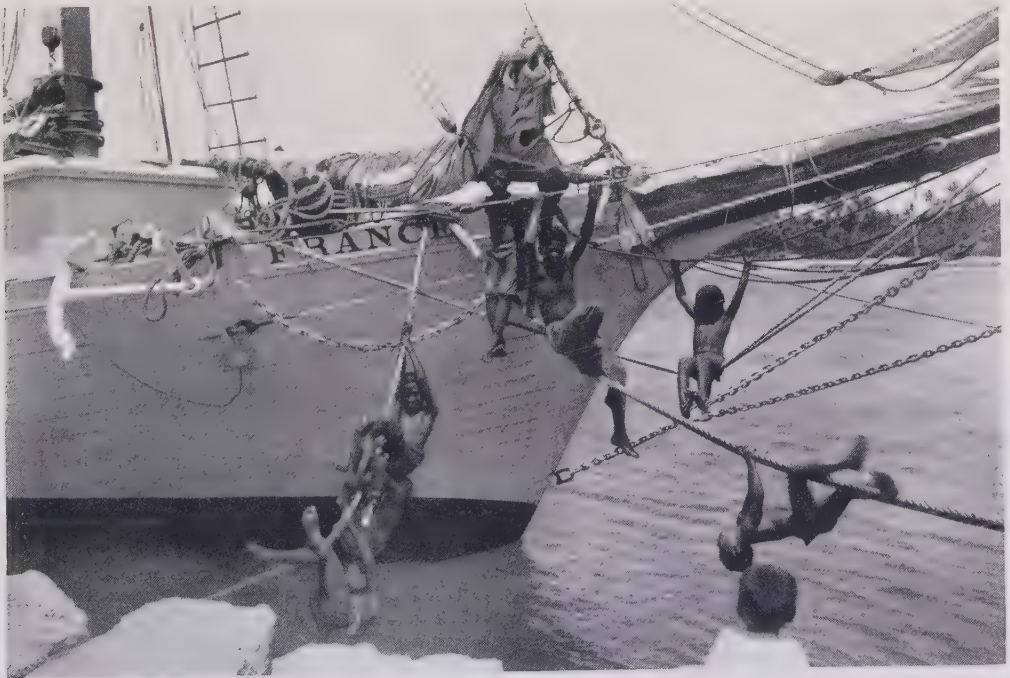
The first view of Christmas Island was of two or three distant sand hills. It was obtained several hours after the vessel should have been at the center of the island, if the skipper's morning observations were to be credited! Discounting the astronomical calculations, they had been sailing steadily westward, knowing by the constantly increasing numbers of seabirds that they were heading on the right course.

Just before dark the mate climbed to the masthead and reported land both dead



THE PRECARIOUS NEST OF A FAIRY TERN

The most delicately beautiful of all sea birds (see illustration, page 401) deposits its single egg on the rough bark of a horizontal limb, upon a broken stub or even on the shaft of a palm frond.



AFTER SCHOOL HOURS AT MANIHĪ

The native boys used the *France* and its hawsers as a gymnasium.



SOOTY TERNS ABOVE THE GREAT BREEDING COLONY OF KAUHI ISLAND: TUAMOTUS

These birds (*Sterna fuscata*), familiarly called "wideawakes," are so numerous that Yankee whalers, who were accustomed to gather the eggs for food, reckoned the population by "acreage" rather than by numbers, and so recorded the extent of the colonies in their log books.



PORTRAIT OF A RED-FOOTED BOOBY SHELTERING HER CHICKS
 This is a long-tailed, perching species and the only Pacific booby which
 builds its nest in trees.



A FAIRY TERN, THE LOVELIEST OF SEA BIRDS
 The adults of this species are snow white, with dark hills and feet and
 extraordinarily large eyes.

ahead and on the starboard bow. They then realized that they were off the treacherous bight on the eastern coast of the island.

On account of a strong ocean current, a sailing vessel in a light breeze has little chance of beating out of this pocket if she has entered more than a short distance. So sails were trimmed, the motor started, and the schooner stood offshore until the approach of daylight.

Later in the day the *France* moored at the spot where Captain Cook had first dropped anchor on Christmas day, 1777.

At six o'clock on the following morning the naturalists were rowed ashore and found a dark-skinned chauffeur awaiting their pleasure at the wharf.

To watch boobies, man-of-war birds, several species of terns, and many other birds from the breezy front seat of a Ford, which had neither a top to obstruct the vision nor a windshield to block camera or gun, was hardly to be anticipated when starting for remote and rarely visited islands in the South Seas (p. 364).

A short stretch of elevated coral rock near the settlement of the copra workers had required paving, and the readiest material had evidently been coconut fronds. At low speed, the Ford negotiated this strip very handily. Thereafter it proved good going for 20 or more miles, although at one or two crossings over narrow isthmuses the bristling coral looked dangerous for tires.

For a few miles after leaving "London," the port of Christmas Island, the road wound through endless series of coconut groves, and the skill of the Polynesian driver in missing most of the fallen nuts which dotted the roadway gave constant cause for wonder.

Whenever the wheels struck a glancing blow, the nuts shot to one side—and how the land crabs scurried! At the approach of the machine many of these crustaceans would dodge into holes, but occasionally one would stand ground and raise threatening claws.

BIRDS WITH "TOY-BALLOON" THROATS

In low bushes along the way, sometimes only a foot or two above the ground, the man-of-war birds were occupying loosely built nests. Three or four of the red-

pouched males were often seen sitting together on a shrub, with wings extended and heads pointed skyward toward some soaring female. Their distended throat sacs looked like toy balloons, and when such birds were driven from their perches, they seemed to find difficulty in carrying the encumbrance, and would travel on an uneven keel until the sac collapsed.

Male birds appeared greatly to outnumber females. Whenever one of either sex was frightened from its nest, a strange male was always likely to swoop down and settle contentedly on the egg, whereupon the presumably rightful owner would make vicious but vain lunges at the intruder.

CHRISTMAS ISLAND HAS UNIQUE WARBLER

At many of the islets or motus in the great lagoon of Christmas Island, large breeding colonies of petrels, tropic birds, terns of *seven* species, and other rare water birds were found. The only land bird of the island—the *kokikoko*—a little gray warbler found nowhere else in the world, and not previously represented by specimens in any museum, was also collected.

The sooty terns of Christmas Island range regularly 150 miles out to sea from their nesting colonies. The island, which looms but a few feet above sea level, can hardly be visible to the birds at a greater distance than 20 miles. Although many do their fishing inside this range, flocks of from 10 to 300 go several times farther. That the darkness of night has no perceptible effect upon their coming and going, is evidenced by their creaking cries, which one can hear as they pass a ship.

Even the combination of darkness, dense fog, and drizzly rain does not prevent sea birds from finding their nests, as is proved by the fact that several kinds of petrels select the thick forests of high islands in which to dig their burrows, and then depart from and return to them only at night.

At several members of the Marquesas Group and at the majority of the 51 islets of the Tuamotu Archipelago visited the members of the Whitney Expedition were the first naturalists ever to make zoölogical observations of any description. What changes, incidentally, their notes reveal,



©

Photograph by Rollo H. Beck

A MAIDEN OF RAPA, AUSTRAL ISLANDS

Papote, filling her gourd at the brook, as her forbears have done from time immemorial.



©

A SEA-BEATEN GLEN OF THE MARQUESAS

Photograph by Rollo H. Beck

Omoa Valley, in the small island of Fatuhiva, the essence of all that is loveliest in the isles of the South Seas.



© Photograph by Rollo H. Beck

TAIOHAE BAY, NUKUHIVA ISLAND

A characteristic scene on the dry or leeward coast of one of the Marquesas, with copra and trading schooners at anchor.



©

A HAVEN IN DISTANT RAPA

Photograph by Rodlo H. Beck

Ahurei Bay, the harbor of Rapa, southernmost island of eastern Polynesia. Beds of taro, whose roots are a food staple in the South Seas, gleam on the narrow plain at the head of the bay. Beyond the grove are the stone pier and the community church, the Whitney Expedition schooner at anchor, and the bright Pacific stretching eastward.



©

LES ÎLES DANGEREUSES

Photograph by Rollo H. Beck

“The Dangerous Islands” of French Oceania are well named. The photograph shows the looming reefs and islets of Tenararo, one of the numberless atolls of the vast Tuamotu Archipelago, as first seen from the deck of the *France*.



©

Photograph by Rollo H. Beck

WASH DAY AFTER A LONG VOYAGE

In a clear streamlet beneath the weathered, lava battlements of Omoa Valley in Fatuhiva Island, Marquesas Group, the Polynesian sailors of the schooner *France* wash their prosaic, workday clothing of shipboard, reverting for the time to the picturesque attire of the red *pareu*, a strip of calico which in recent years has supplanted the *tapa* cloth made from beaten tree bark,



©

Photograph by Rollo H. Beck

THE "GIRAFFE OF VEGETABLES": HUAPU, MARQUESAS

So Stevenson calls the coconut palm. Speaking of the rock formations, he wrote, "—the needles of Ua-pu . . . pricked about the line of the horizon; like the pinnacles of some ornate and monstrous church, they stood there, in the sparkling brightness of the morning, the fit sign-board of a world of wonders."



©

HOUSEHOLD LABOR IN RIMITARA

Natives of Rimitara, Austral Islands, grating coconut meat. The effective utensils are carved upon the 'necks' of the heavy, quadrupedal stools. The native girl at the right shows pronounced mongoloid characteristics.

Photograph by Rollo H. Beck



Photograph by Rollo H. Beck

THE CHIEF'S HOME IN RAPÁ

This pastoral dwelling was but one of several in which the members of the Expedition were feasted to the verge of collapse during their cruise among the Austral Islands.

©



©

Painting by Hashime Murayama

FRUIT PIGEONS OF THE SOUTH SEAS

Above are a male (left) and female (right) of the exquisite species common to Samoa and Fiji, and called *Ptilopus perousei* in honor of the early French voyager, La Pérouse. Below is a large, raspberry-breasted fruit pigeon (*Thyliphaps huttoni*) peculiar to Rapa.



Painting by Hashime Murayama

©

BEAUTIFUL VARIETIES OF FRUIT PIGEONS

Above, the white-crowned, Marquesan fruit pigeon (*Ptilopus dupetithouarsi*); at the lower right a rose-crowned species (*Ptilopus tristrani*) found only upon Hivaoa Island, Marquesas Group; beside it is the purple-crowned Tahitian species (*Ptilopus purpuratus*).



Painting by Hashime Murayama

LAND AND SEA BIRDS OF POLYNESIA

The upper bird is a widely distributed parasitic cuckoo (*Urodynamis taitiensis*); below it the little Marquesan kingfisher (*Halcyon godeffroyi*); and, at the right, the red-tailed tropic bird (*Phaethon rubricaudus*).

©



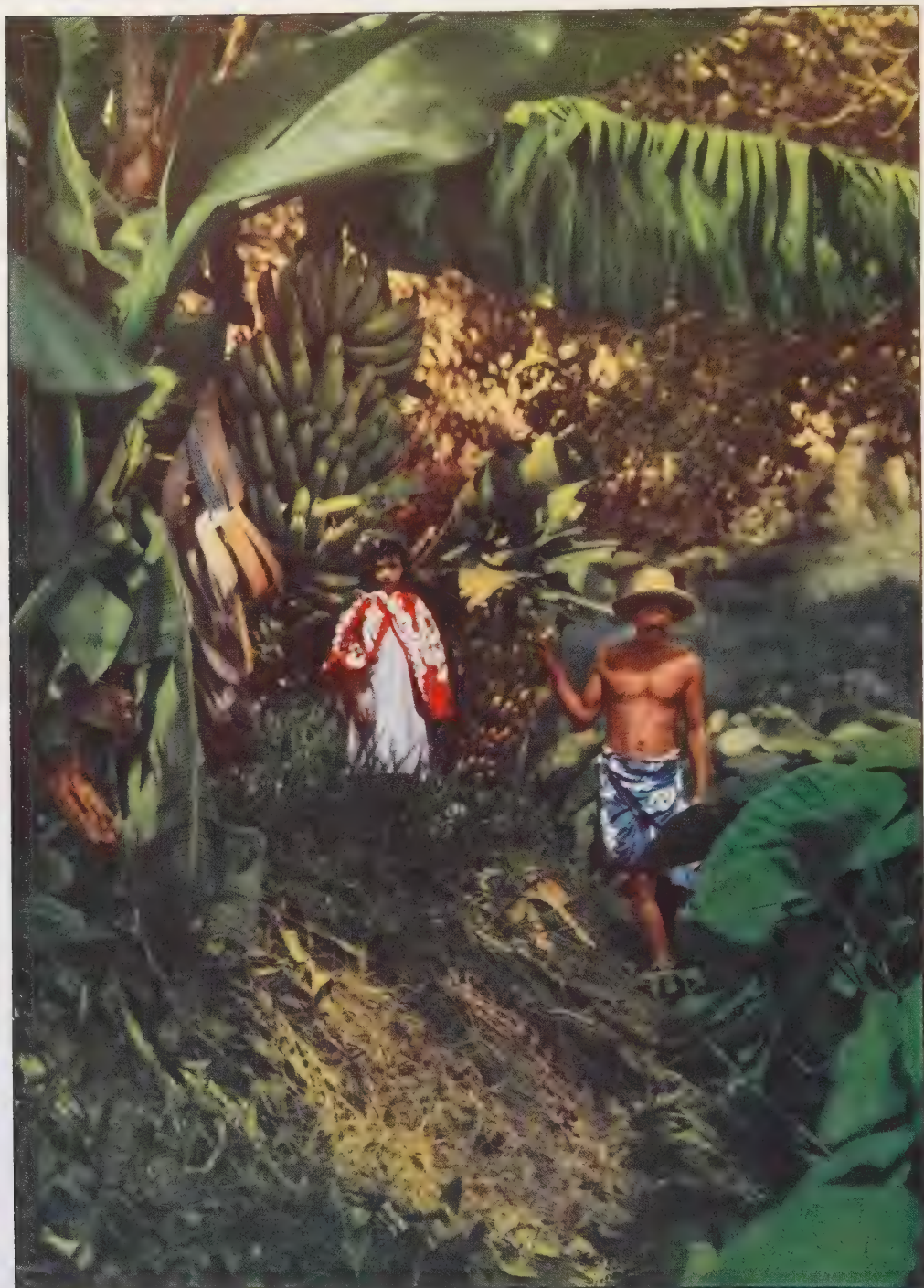
©

BRUSH-TONGUED PARAKEETS

Left, the species known as *Coriphilus peruvianus*, although it does not occur in Peru; center, the red-breasted parakeet (*Pipi kuli*) of the Austral Islands and elsewhere; right, the bizarre Marquesan species (*Coriphilus smaragdinus*). One or more of these have been distributed far and wide by the pet-loving Polynesian islanders.

Hashime Murayama

Painting by Hashime Murayama



©

Photograph by Rollo H. Beck

A GARDEN OF EDEN, IN THE AUSTRALS

A scene on the hillside of Rimitara, with ripening bananas, elephant-eared taro leaves, and two citizens of a land where food is produced without sweat of the brow.

IRIDESCENT ISLES OF THE SOUTH SEAS



©

Photograph by Rollo H. Beck

A WELL ON KAUKURA ISLAND

The fresh water of the Tuamotus comes from shallow surface diggings, and is derived from rain or through natural filtration from the ocean.



©

Photograph by Rollo H. Beck

LADS OF RAPA

These boys, who served as guides, fail to understand the elation caused by the discovery of a Polynesian teal's nest.

when compared with records of a century or 50 years ago!

The Gambier cluster of the Tuamotus, for example, in which is included Mangareva, government seat of the eastern half of the colony, has now a population of 500. Formerly it was inhabited by 1,900 natives.

Crumbling stone houses line the shores of Mangareva. A convent, which in years past housed hundreds of girls, is to-day covered by the growths of the encroaching jungle and will soon be only a memory.

The cathedral of the island is larger than that in Papeete, and is decorated about the altar with thousands of pearl shells, telling of a congregation that is no more.

Anaa, in the western part of the archipelago, has but a handful of people, yet it was once the savage stronghold of the Tuamotus and was reputed to have a population of 5,000, as noted by Wilkes in 1839. In common with many others among the low islands of the Tuamotus, Anaa has suffered severely from hurricanes.

With reference to the dwindling and rapidly shifting population of the Tuamotus, under modern industrial conditions, Mr. Beck's journal mentions a motion-picture theater at the island of Takoumé, with nobody now living within five miles of the building!

RAPA WAS ONCE A FORTIFIED STRONGHOLD

Of the Austral or Tubuai Group, far south of the Societies, the most fascinating island is Rapa, which lies detached from the others, well beyond the Tropic of Capricorn.

Rapa was discovered by Vancouver in 1791. For the next 35 years the native savages had little contact with the outside world, but about 1825 they began to be Christianized through the first intercourse with Tahitian missions.

In later years Rapa became a favorite port of call for whaleships, because the men of the island were peerless boatmen, but with the decline of whaling, the curtain of isolation once more descended. Now Rapa is visited only two or three times a year.

Twice during the Whitney Expedition periods of a week or longer were spent at

Rapa. On the first visit Mr. Beck tramped off across the taro fields and through the coffee groves toward one of the ancient and mysterious forts that top the ridge of the island (see illustration, page 420).

Climbing through ferns knee-deep, he soon reached the crest. Four distinct levels on the ridge had been protected by built-up rockwork, and at the highest point a massive wall had been constructed as a last stronghold. On a leveled terrace just below was a small rainwater cistern.

Four miles away in an air line, two other forts stood up against the sky. These were so built that a small force could defend itself against a host of besiegers as long as food and water held out. The only approach was by way of the ridge, for the adjacent sides of the mountain were too steep to scale.

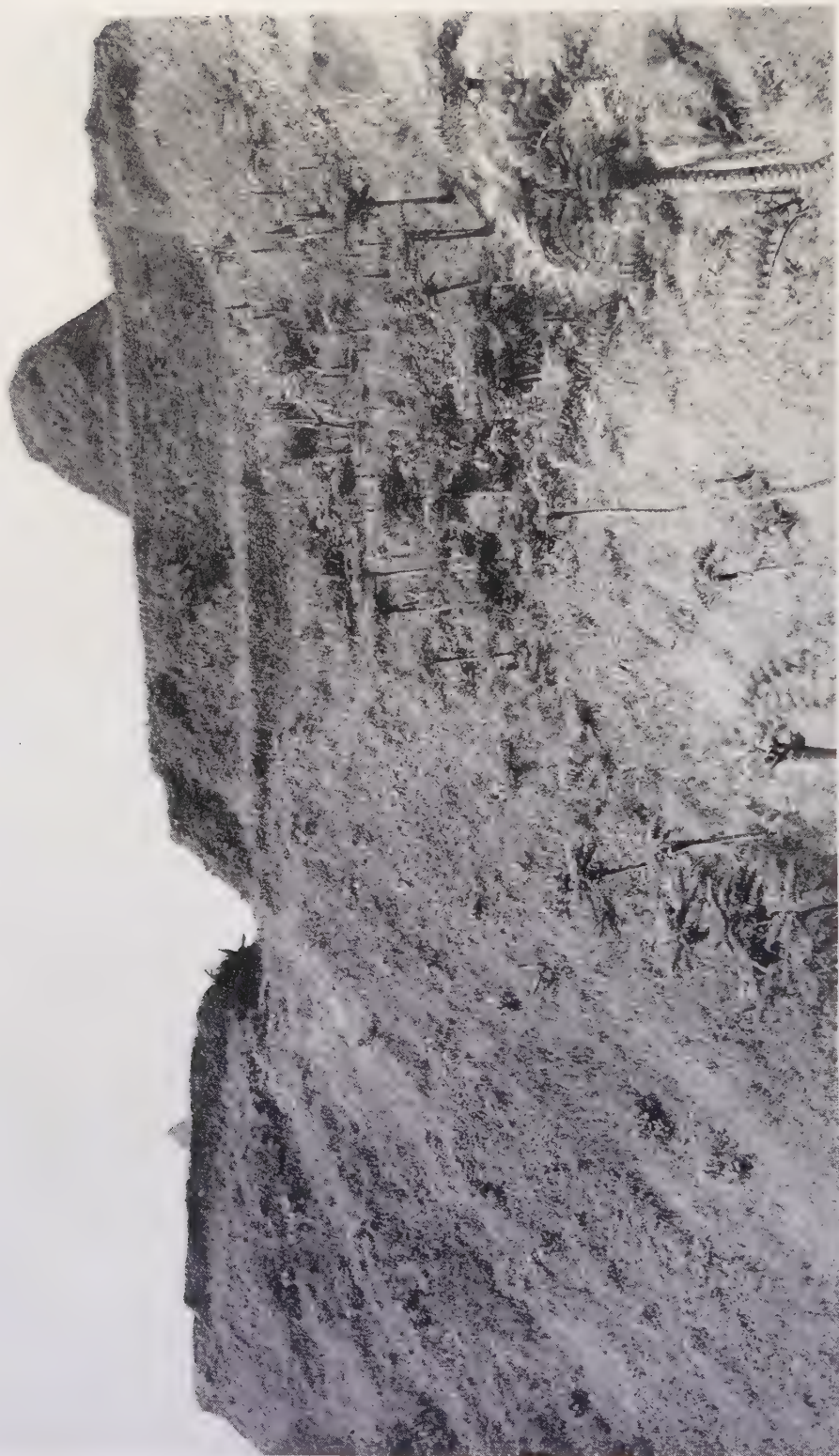
Down to eastward the beautiful harbor of Ahurei, with scattered taro beds about its head, showed clearly (see Color Plate IV), while high above the village wild goats could be distinguished along the craggy ridge. South of the fort the hill rose to nearly 2,000 feet, forming a backbone of unclimbable cliffs, while toward the west and north other ridges divided narrow valleys and cut the island into sharply defined districts.

Upon returning to the shore, Mr. Beck found the captain and mate and their wives enjoying the charming garden of the French administrator, where fig and orange trees were weighted with fruit.

A splendid crop of tobacco, maturing in a small grove, also bore witness to the rich soil and the favorable climate.

THE TRIALS OF DINNER GUESTS IN RAPA

While they were lingering in the garden, the native chief's son arrived to lead the visiting guests to a Sunday feast. On the way thither they were followed by a troop of the island children, some in shirts, some in *parcus*, one in the discarded vest of an itinerant visitor, and several of the youngest wearing nothing at all. As they entered what was at first supposed to be the residence of the chief's son, the supercargo, who knew the customs of Rapa, warned all the strangers to eat lightly, as they would be expected to partake of food at several additional homes.



POLYNESIAN FORTIFICATIONS ON THE CRESTS OF RAPA (SEE PAGE 419)

The full significance of these ancient structures is hardly less enigmatical than that of the great stone monuments of Rapanui, or Easter Island. (See "The Mystery of Easter Island," by Mrs. Scoresby Routledge, in the NATIONAL GEOGRAPHIC MAGAZINE for December, 1921.)



A KING'S TOMBSTONE ON RIMITARA ISLAND
A Christian memorial, but not without reminiscence of the old
paganism.



AN OLD IDOL IN THE FOREST OF VAVITAO
Many such stone carvings (*tikis*) were overthrown and destroyed after
the Christianization of the natives.



A SCHOOL, TEACHER AND HER SISTER ON THE OBSERVATION POST
OF MANHI ISLAND, TUAMOTU GROUP



THE ROMAN CATHOLIC CHURCH AT MAKEMO ISLAND,
TUAMOTU GROUP



AN AGED INHABITANT OF TAENGA, ONE OF THE CORAL ISLETS
OF THE TUAMOTUS



TAKING NATURAL HISTORY NOTES ON FAKARAVA ISLAND,
TUAMOTUS



A PREHISTORIC WALL OF LICHEN-COVERED SLABS, RIMITARA ISLAND

Fresh banana leaves had been laid in a row across the mat-covered floor, and at each place was a plate containing one or two whole fish, another with several large pieces of juicy pork, and beside the plates a taro root. Seating themselves on the mats, the diners ate with their fingers.

When the first few pieces of fish gave way to the pork, the serving maids brought in the *poipoi*, the Polynesian staff of life resembling sticky, yeasty dough, neatly wrapped in the broad green leaves of the *rauti* plant.

While they were still eating, the son of the chief appeared again and advised them to hurry, as dinner was awaiting them at his home. So, leaving the untasted residue of the first banquet, they walked to the scene of a similar repast. In addition to fish, however, they here found a whole lobster at each place, and *two* taro roots instead of only one.

Before this meal had proceeded far, the captain leaned back from his partly eaten lobster, which was close to two feet long, and in deference to his example the other guests first slackened their pace and then ceased.

They next passed along a lane to a thatched cottage smaller than the others, and encountered a repetition of what had gone before, except that deliciously cooked chickens replaced the pork.

The supercargo again reminded them to eat sparingly, as a hearty appetite should be reserved for the chief's home, to be visited next!

When the party finally strolled over to the large dwelling of the chief, his wife and three or four girls welcomed them in the open yard before the door (see Color Plate IX).

In this house, lobster, pork, and chicken were in readiness as a last test of gustatory capacity. The taro had been increased to three big roots, although a small bit from the end of one root would easily have sufficed for a meal.

Besides the staples, the chief had supplied coconut milk in which to dip the meat and roots, a rare beverage in Rapa, as coconuts can be obtained only from ships coming from more northerly islands. They were served also with molasses made from the roots of the *rauti*. The syrup was placed on the plate with the



HARDSHIPS OF AN EXPLORER'S LIFE

The leader of the Whitney Expedition and the engineer of the *France* are about to regale themselves with boar's head, fish, chicken, breadfruit, poipoi, fruits, and other staples of Mangareva (see, also, account of the feasts on the island of Rapa, pages 419-424).

poipoi, enabling the latter to go down more easily than when it was lubricated with water only.

At the conclusion of what, fortunately, proved to be the last meal, bananas were passed around.

FAREWELL GIFTS BESTOWED BY A
HOSPITABLE PEOPLE

On another day, a few of the hardy, energetic native fishermen made a trip to the lobster beds at the entrance of Ahurei Bay, and brought back 100 lobsters for the visitors. Practically every house in the village entertained one or more of the schooner's crew during the entire stay.

At the captain's suggestion a case of kerosene was presented to the church, the light of which shows up brightly as vessels enter the harbor.

That this courtesy was appreciated by the inhabitants was shown by their gifts on the day of leavetaking. A count of the acquisitions on deck, after the departure of the pilot, showed 5 sacks of taro, 18 packages of poipoi wrapped in rauti leaves, 19 boxes of taro and poipoi, 15

bunches of bananas, 22 rabbits, and 14 goats. Very few of these items had been purchased; the greater number were presents from the most hospitable people in the Pacific.

The girls and younger women at Rapa do most of the labor in the taro fields, while the older women attend to the housekeeping (see illustrations, pages 370, 381, and 382). The exemption of the men from agricultural labor allows them more time for fishing, and as a result of their sea experience they are much sought by captains of sailing vessels at Papeete.

The constant demand for Rapa men during a period of nearly a century has led to a considerable preponderance of women in the island population.

RAPA NATIVES ARE PEERLESS BOATMEN

Upon the second visit of the expedition, when the *France* was three or four miles from shore, a boat came out to meet the schooner. The men had made no allowance for the fact that an engine was aiding the sails, and within a minute they



TWO MEMBERS OF THE EXPEDITION DISCOVER A BOOBY'S NEST ON FAKARAVA ISLAND

were left 100 yards astern. But when the cabin boy, a native of Rapa, called out to them to catch up and be towed, they bent their oars and showed what they could do.

The schooner was progressing at a rate of about six miles an hour, but the boat was going at twice that speed when it neared and overtook her.

On another occasion a Rapa crew rowed five miles to an islet on which certain sea birds were nesting. Two of the members of the crew were only about 13 years of age, but when a heavy storm arose these lads stood the test of pulling for hours against a head wind and a rising sea, even though the poorly balanced, homemade oars weighed close to 50 pounds.

GIRLS OF RAPA ARE EXPERT IN HANDLING OUTRIGGER CANOES

The girls of Rapa are scarcely less skillful in using their unstable-looking outrigger canoes. At evening they would

frequently pass the schooner on their way home from taro fields on the far side of the bay, with heavy loads of the roots weighing down their narrow dugouts almost to the swamping point (see illustration, page 381).

From babyhood these people become familiar with the sea. At all hours the children can be seen playing in the water or paddling tiny canoes alongshore.

The whole population of Rapa, exclusive of a few lepers confined in another valley, was living in or near the village on Ahurei Bay at the time of the Whitney Expedition visits.

Five or six valleys that formerly supported villages (and which may have warred with one another in their oceanic microcosm from immemorial time) are now deserted.

Only the lofty, stone forts, last refuge of the inhabitants of these communities (see page 420), still stand as monuments on the hilltops, and can be discerned from far at sea.

COLLARIN' CAPE COD

Experiences on Board a U. S. Navy Destroyer in a Wild Winter Storm

BY LIEUTENANT H. R. THURBER, U. S. NAVY

ON BOTH sides of the long dock at the Yard flurries of action told that the other ships of Squadron Nine were getting ready to shove out into the stream. Whistles and sirens were being tested, safety valves blowing off, the exhaust steam scurrying away down the wind, men running about decks, signalmen tailing pennants of signal orders to the yardarm and whipping them out into the fresh breeze. It was crisp weather, such as kept all hands moving to prevent stiff fingers and toes.

"Is everything ready, Page?" Captain Welles was looking along the dock.

"All ready for getting under way, sir," replied the Executive Officer, saluting smartly.

"Well, let me see." The Captain was musing aloud, a twinkle in his eye. Only a two-and-a-half striper (lieutenant commander), Captain Welles, nevertheless, was known throughout the entire fleet as a destroyer handler *par excellence*. "Sort of looks as if we might hang up on that lighter if the tide catches us; or, if the wind hits our bow, we might be in a bad way on the piling at the end of the dock. What do you think, Page?"

"I think if we backed our port engine one-third, sir, with right rudder, we would clear nicely and easily," said the "Exec."

"Well, I don't know. Suppose you take her out."

From my position, discreetly removed from the front of the bridge, I turned to the Chief Quartermaster.

"Say, Stearn, what's the idea?" I nodded toward the Captain and Page.

Stearn, red-haired and bright of eye, taking cognizance of my ensign's single stripe, explained.

"Well, you see, Mr. Hall, the Captain believes in letting his officers handle her, especially the Exec. These here destroyers have pretty near as much horsepower

as battleships, and they can move fast. And you never know which way they're wantin' to go."

SAYING FAREWELL TO SNOW-COVERED
BOSTON

Sharply at two the K * * * 's whistle tooted, the icy lines were hauled aboard, and we slid gracefully out into the stream. Heeling down river, we whipped up our wake and proceeded toward President Roads. The bite of the cold wind caused those not needed above decks to hunt the heated living compartments as soon as the lines were reeled and loose gear was stowed and lashed. It was my portion, as "makee learn," to stay on the bridge.

After observing the ease with which Page got the ship under way from the dock, I sought the lee wing of the bridge, watching with keen interest the water front and shipping.

Stearn joined me.

"Look there, Mr. Hall." He pointed back toward the Navy Yard, where two flags were being hoisted—a red flag with a black center over a red pennant. "South-east storm warning, Mr. Hall," he remarked with something akin to a malicious smile.

A few hundred yards ahead of us the squadron flagship, the S * * *, was showing her heels to the ships astern. Close on our port quarter the foremast of the L * * *, towering upward some hundred feet, came to view, and then her bridge and four stacks were visible; soon she went racing past to assume her position in column, the roar of her forced draft blowers sounding like that of an express train.

Over there, at one of the many docks which lined the water front, a tug was puffing out, pushing an unwieldy barkentine with snow-whitened rigging. An inbound coastal steamer was screeching for the right of way over a lumpish trawler



Photograph from Hamilton Maxwell

THE CHARLESTOWN NAVY YARD, BOSTON, MASSACHUSETTS

In addition to being an important Naval station and possessing one of the world's largest dry docks, this Navy Yard is also the home port of the *Constitution*, the famous "Old Ironsides." This fine old ship, made immortal by her many victories, especially that over the English ship *Guerrière*, in 1812, was a 44-ton frigate. She was saved from scrapping in 1830 by Oliver Wendell Holmes' thrilling poem, "Old Ironsides," and since 1877 has been used some as a training vessel. She may be seen in the left foreground, with three destroyers moored in the same slip to the right and the great dry dock a little to the left and beyond.



Official Photograph, U. S. Navy

LIKE AN ARROW IN FLIGHT

The larger destroyers have a displacement of more than 1,200 tons, are about 300 feet long, and have a 30-foot beam. They are oil-burners and can attain a speed in excess of 30 knots. Their armament usually consists of four or five four-inch guns, two or more sets of torpedo tubes, two mounted machine guns, and a store of depth bombs.



Official Photograph, U. S. Navy

ACTION ON THE SIGNAL BRIDGE (SEE, ALSO, PAGE 467)

The man at the extreme right is receiving a semaphore message through the telescope, while the one standing on the rail in the center is sending the same kind of message, his arms forming the letter "U." The two men at the left are hoisting signal flags just taken from the flag locker in front of them.

hugging the wrong side of the channel, close to an ice-topped can buoy.

Down toward President Roads, where the North and South channels forked out to seaward, was anchored a fleet of barges, low in the water, waiting settled weather and a tow through Cape Cod Canal.

The prolonged snowfall, lasting through the Christmas holidays, had whitened the muddy banks of the channel, covered the roofs and docks of warehouses along the river front, and mantled the surrounding hills with a heavy winter coat. Overhead the sky was leaden and the wind was tumbling cumbrous clouds hurriedly out of the southeast.

On the bridge we were muffled to the ears now; for, as the ship had picked up her speed, the raw air had nipped our faces to a bluish hue. The Captain, enveloped in heavy uniform overcoat, his hands stuffed into side pockets, paced the

bridge briskly, glancing now and then at the chart, by which he was conning the K * * * down harbor.

We were in position in column by this time, three ships between us and the flagship. The Exec. kept us smartly at our proper 300 yards' distance astern of the L * * *. Trailing us, well closed up, were our eleven other squadron mates.

In a short time we were sliding past buoys close-anchored in the strong current of the North Channel. As the course was changed eastward and the white tower of The Graves appeared, we began to pitch lazily. Wind and sea from the Bay were backing an ebb tide, and out farther the gray-green expanse of open water was spread with whitecaps.

THE STARBOARD TURBINE BREAKS DOWN

"Huh!" I mused. "Looks as if my initiation is about to begin."

My "initiation," however, was due to



Official Photograph, U. S. Navy

CHARTING THE COURSE

This young sailor is being initiated into some of the mysteries of navigation by the officer at his side.

be delayed, for the Senior Engineer Officer, chagrin in his eyes, dashed up the bridge ladder.

"Captain," he announced, "starboard turbine bearings are all running hot. I'd like to look at them before we go outside. We can run on the port engine until we're ready to lift the starboard bearing caps, and then we'll have to stop and examine them."

Captain Welles strode to the engine-room annunciators. "Hoist the breakdown flag," he ordered curtly. "Sheer out to the right, Page."

As the ship swung out of column, he rang up "Stop!" on the starboard engine annunciator.

"All right, Johnston," he shot out. "Fix 'em. Let me know when you're ready to stop everything." He wagged his head and snorted. "Knew those bearings needed overhaul by the Yard. Signal the Squadron Commander, Page. Request permission to stop and examine hot bearings."

A waiting signalman jumped up to the flying bridge with a pair of semaphore flags; another hoisted the call pennant for the squadron flagship. The S * * * answered, and the semaphore flags began to snap their message (see page 430).

It was a matter of half an hour before Johnston reported he was ready to look at the bearings. The port engine was stopped, and examination revealed that further steaming was impossible until repairs were effected. After getting permission from the Captain, Page ordered "Let go!" and the port anchor splashed over the side. It was then 3:30 o'clock. Boston Light Vessel was visible southeast about five miles.

"Hall can stand the deck watch at anchor, don't you think, Captain?" Page asked.

"Yes, certainly. You've had some deck-watch duty on battleships before, I believe, Hall? Johnston, how long before you'll be ready to get under way? Eight o'clock! I'll have to notify the Squadron Commander. Guess this means we'll go on to Norfolk alone. Don't like it, either." He stamped down the bridge ladder.

I could well understand the Captain's annoyance. The ship had not been overhauled to suit him because of a shortage of money for the work. Then, too, the crew contained but a skeleton of seasoned men. There were many new men, a majority of whom were recruits fresh from



"SAIL, HO!"

Official Photograph, U. S. Navy

During the World War a lookout descending from the crow's nest caused a convoy of ships some anxious moments when his foot slipped. In the hurried descent that followed, he fell across the whistle cord and a prolonged toot resulted. Thus momentarily held up in his fall, he grasped for something to hold to and chanced to seize the halyard that released the green flag from the yardarm. It so happened that a long blast of the whistle and running out a green flag were the signals of a submarine attack, and, while there were no U-boats in the vicinity, the sailor's carelessness caused an alarm to be sounded.

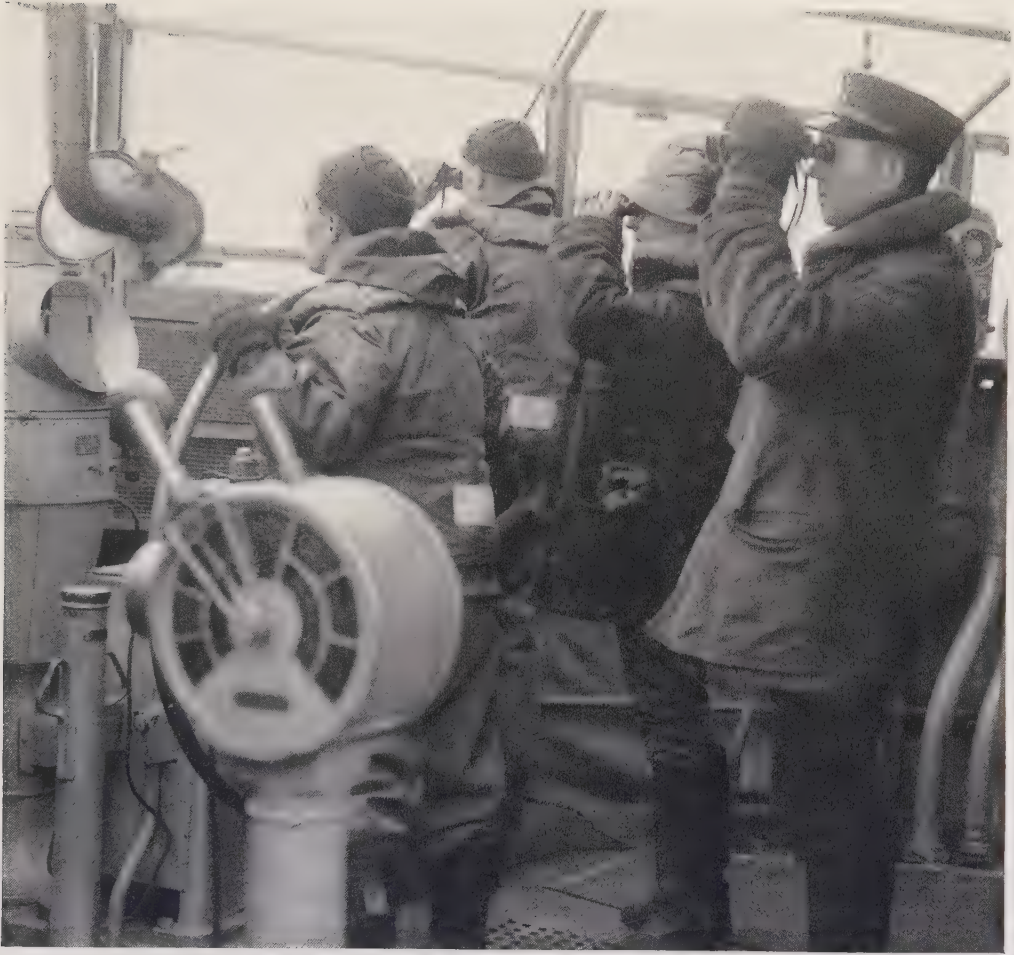
a training station, and had been received on board at the eleventh hour. This greenness of personnel extended even to the officers, for Atkins and I were but ten days on board, and in the particular case of officers we were short-handed as well.

THE SEA BEGINS TO "KICK UP"

Left as Officer-of-the-Deck, I busied myself looking over the charts laid out for the voyage to Norfolk, glancing occasionally around the horizon. The sea had commenced to "kick up" a little and the K * * * rose and fell gently, straining lightly at her anchor. The wind was growing stronger, bringing a fine sifting of snow, which in the course of half an hour grew into a thick, white veil. By four bells a driving snowstorm had set in around us, walling in the ship as if she were incased in a shroud.

I sent for oilskins and rubber boots, and, shielding my eyes from the pelting flakes, began pacing the bridge, directing the quartermaster on watch to sound the ship's bell rapidly at regular intervals.

Only once during the watch did I stop pacing. This was when the C * * *, the last of the squadron to complete re-



Official Photograph, U. S. Navy

▲ A BUSY WATCH ON THE BRIDGE

The man on the left is at the wheel, steering the vessel by the compass in the open case at his side. The instrument in the foreground is the engine telegraph (see, also, illustration on page 441).

pairs at the Yard, roared past, looming large as she ranged alongside, and then vanishing almost immediately into the curtain of white.

"Hot dog!" I exclaimed to the quartermaster. "I could have tossed a spud on her bridge!"

UNDER WAY ALONE FOR THE RENDEZVOUS AT NORFOLK

It was not until 8:15 that repairs were completed. Atkins, swathed in oilskins, had relieved me at eight bells, bringing news that the skipper had received a radio from the Squadron Commander to prepare for heavy weather.

At 8:30 the K * * * 's anchor was weighed and we were under way, headed southeast toward Boston Light Vessel. The red and green running lights and the white masthead light peered dimly at us on the bridge through streamers of snow outlined against the darkness, as we sped on our way, lurching and tossing occasionally in the rising sea.

I had remained on the bridge after being relieved and was standing at the Exec.'s elbow.

"Kind of thick to-night, isn't it, Mr. Page?" Page, his eyelids fringed with white, continued his search dead ahead, as he replied.



© O. W. Waterman

HEADING TOWARD NORFOLK, WITH CAPE COD "COLLARED"

With its long, rakish lines and narrow beam, the destroyer is the speediest and most mobile unit of the fleet. Although lying so low in the water that the waves often wash over its decks, it is an exceedingly seaworthy vessel.



Official Photograph, U. S. Navy

"SCUPPERS UNDER"

A destroyer in a rough sea is far from being a comfortable place in which to live. In the words of one who has been there, "The craft rolls dips, shudders, plunges like a horse straight up at the stars, sinks rapidly and horribly, and even has spells of seesawing violently from side to side. Its worst motion is an unearthly twist—a swift, appalling rise at a breath-taking angle, a toss across space to the other side of a wave, a fearful descent sideways and down, and a ghastly shudder."



Official Photograph, U. S. Navy

"HEAVING THE LEAD"

The leadsman, standing in the chains, uses the lead for taking soundings of the depth and nature of the sea bottom. The weight is hollowed out on the bottom, and this cavity is treated with tallow, which picks up some of the sand and shells from the floor of the ocean. By comparing the information thus obtained with his chart, the navigator is able materially to supplement the findings of sextant and compass (see text, page 448).

"Yep. Got to see this light, though, so we can shape a course to Cape Cod or Peaked Hill Bar gas buoy. Unless we get a good departure from Boston Light Vessel, we'll be wandering around pretty much in the dark off Cape Cod, and there are enough wrecks piled up on the cape now."

Twenty minutes passed. On Page's suggestion, the Captain slowed speed.

"Don't want to run afoul of the light-ship," muttered the Exec. "Couldn't see her much before we hit her. Ah!" It was a sigh of relief, for there, close aboard, on the starboard bow, was the blinking white light, dimmed in its range almost to uselessness by the driving snow.

I watched the Exec. as he laid the course on the chart for Peaked Hill Bar gas and whistling buoy. Page, singing out the new course to Atkins, turned, nearly walking over my feet.

"Say, son," he exclaimed, surprised at my presence, "you'd better go down and turn in. You'll need all the sleep you can get before 4 o'clock. I'll have you called about a quarter of."

I accepted the advice with alacrity, for, to tell the truth, I didn't care at all for the motions the ship was going through as she came on her new course.

I started down the bridge ladder, my knees unsteady, and had reached the bottom tread when the K * * *, lifted high by a long, green wave, dropped into the trough following it and left me hanging by my hands alone to the ladder rail.

Then the bow was tossed up, my feet hit the steel deck, and the jar shocked me to the topmost hairs. But the bow nosed under the next comber, and, as the ship labored to lift and free her forecastle of



Official Photograph, U. S. Navy

THE "FANTAIL" OF A DESTROYER

This part^d of a destroyer's deck offers damp footing when a great Atlantic "comber" overtakes it. The deep-sea sounding machine, dimly seen through the spray, is the last feather in the fantail.

water, I was caught by the sea which poured aft through a doorway to the forecastle, the water-tight door having been carelessly left open.

It took all my strength to hold on, as the sea slid over the side, leaving me soaked, breathless, and decidedly more wobbly.

"Phe-ew!" I gurgled, "I sure *am* goin' to turn in!"

But sleep was not so easy, as I found after reaching my stateroom. Stripping off my drenched clothes, I rubbed vigorously with a Turkish towel, attired myself in woolen pajamas, and crawled thoughtfully into my bunk. The same lifting of the ship under the heavy seas, with elevator-speed descent into the following trough, caused the springs in the bunk to weave up and down in most irritating fashion.

As the ship was lifted under a wave, it seemed as if I were being swung easily

upward in a hammock; when she crashed down, the springs poised at a high peak momentarily, and then, with a sickening rush, hurtled down, stopping with a thud. It was most discouraging.

I composed myself for sleep several times, but the ship's antics robbed me completely of all rest. Then, too, the air was becoming stuffy under battened hatches, despite the ventilation blower and electric fan in the room, which were drafty and unpleasantly cold.

There were queer noises of creaking, unlatched doors banging and sliding; even the rings on the curtain across my door jangled. And by no means were my digestive organs tranquil, for the weaving of the springs was also weaving the stability of my dinner. During the course of my efforts at composure I damned the steward more than once for serving a dinner of greasy pork chops and creamed asparagus.



Official Photograph, U. S. Navy

A SEAGOING STRAP HANGER

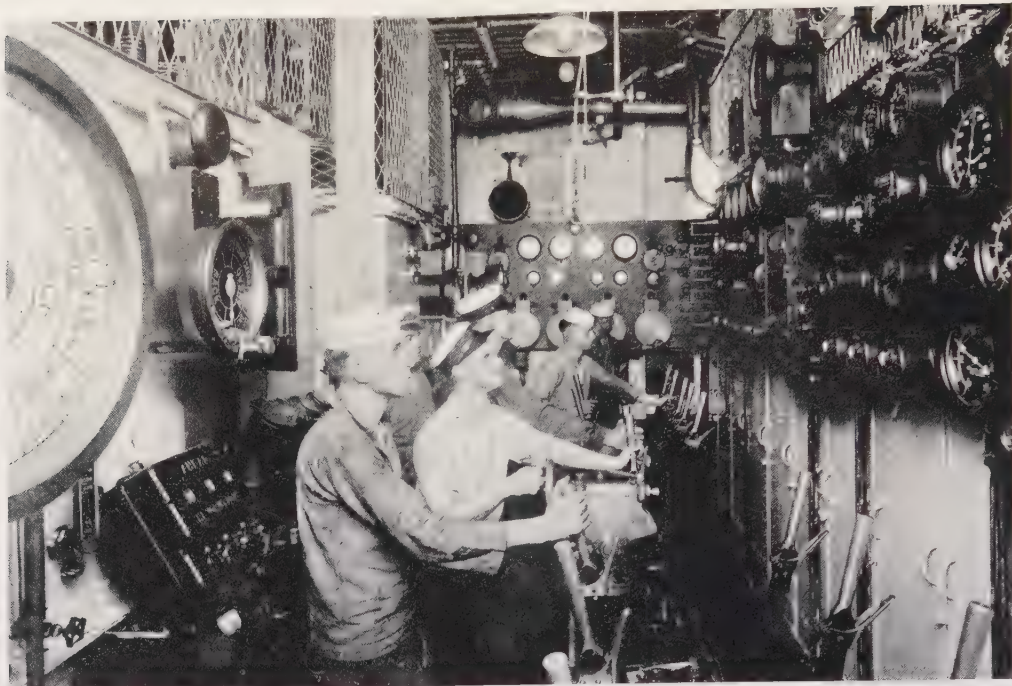
Footing is so precarious on the decks of a destroyer in any kind of rough weather that lines are stretched between various parts of the vessel and short ropes, much like trolley-car straps, are attached, so as to slide along them and provide something for one to hold to. The story is told of a young sailor who failed to hold on to his rope and was swept overboard by a huge wave, only to be picked up by another and deposited on the deck of the destroyer next behind in the line.



© Alfred G. Buckham

A STORMY DAY

This light cruiser has taken a good part of the sea over her bows and is just "coming up from under" again. This is not an uncommon experience in heavy weather, but it is one seldom recorded by the camera.



Official Photograph, U. S. Navy

FULL SPEED AHEAD!

The multitude of levers, dials, switches, and other mechanical devices concentrated here in the control room of the U. S. ship *Tennessee* gives some idea of the magnitude and intricacy of the superdreadnaught.

It was hours, it seemed, before I devised a posture for reclining, but finally attained one resembling that of Mercury lying on his right "statue" side, and in this attitude I drifted off to weary, uneasy slumber. It seemed, too, as if I had not slept more than a few minutes before rude hands were shaking me and a crusty voice was calling me from a far world.

"Mr. Hall! Mr. Hall! Quarter of four! Mr. Page says it's pretty wet on the bridge. Are you awake, sir? Weather's tough. Everybody's sick. Do you hear me? Mr. Hall! Mr. Hall!" Much shaking. "*Mr. Hall!!*"

"Huh? Yeah! All right!" I swung my feet over the edge of the bunk and rubbed my eyes. So this was to be my second day at sea on a destroyer! Why wouldn't the darned ship be quiet!

Dressing was a slow process, for it was necessary to grip something stable with one hand and brace hard with at least one leg to keep from sliding and landing against the sharp edges of the metal furniture.

By eight bells I was on the bridge—weak, but, nevertheless, there. I couldn't see anything on the bridge except the dimmed compass light and the tiny light over the helm angle indicator. The deck was careening and sliding underfoot in a most disconcerting manner.

As my eyes became more accustomed to the darkness, I made out the wing railing of the bridge and gained it. The reflection of the running lights on the waves rushing past wasn't particularly encouraging.

THROUGH TUMBLING PRECIPICES OF WATER

Long curlers, with a 30-foot depth of trough, went whistling past. At one moment the K * * * was in the trough, and at the next was tossed high on a combing mass of seething sea. Then she was sliding rapidly into the next valley, and the shock, as she crashed into the tumbling precipice of water that followed, burying her forecastle under and seemingly knifing it backward, was terrific.



Official Photograph, U. S. Navy

"SHOOTING THE SUN"

This officer is standing on the bridge of his ship making observations with a sextant, from which he will work out his latitude and longitude. The clocklike instrument in front of him is the engine telegraph, by means of which the engineer is kept advised as to the speed desired.

Shielding* my eyes from the spray, I tried in vain to see ahead, but found it impossible to glimpse anything from the depths of the watery canyons except the next curler rushing at us.

A heavy form pressed me against the rail.

"That you, Hall?" It was Page. "Well, it's a corker. What?"

"Yes, *sir!*" I found my voice rather faint, and cleared my throat, resolving not to show weakness.

"Come over to the chart."

We pushed our heads and shoulders up through the canvas flap of the inclosed chart board (see, also, page 431).

"I think we're about here, Hall," said Page, wiping the salt spray off his hands and face and pointing to a position some thirty miles south and east of Cape Cod Light. "We missed Cape Cod Light and also Peaked Hill Bar Buoy. Just as glad we didn't get close enough to see the light. Didn't stop snowing until about two hours ago; couldn't see a thing.

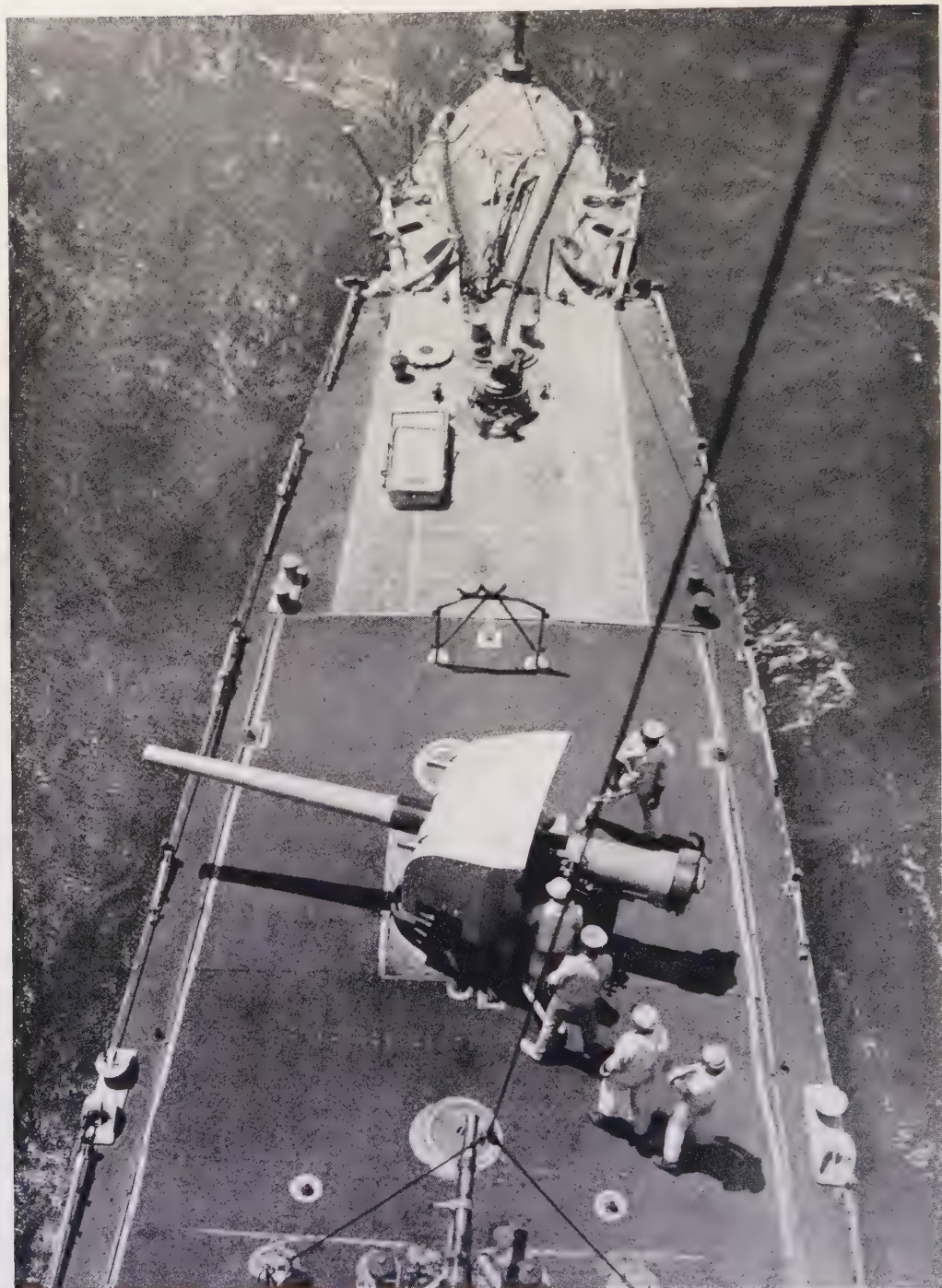
"Had to slow speed to five knots at 1

o'clock. Seas broke a couple of bridge windows in front of the helmsman and battered up the chart house some. Put oil bags over each bow; keeps down the sea a bit.

"We're heading off Nantucket Shoals—course, 145 true, 162 per compass. You can see I've allowed enough on the course, so we won't be set inshore.

"North Truro is the only radio compass bearing we can get, so that doesn't help much. Surfside radio compass station doesn't bear yet and Cape Elizabeth is out of commission for a month's repairs. Makes it rather hard for navigating."

Page paused, smiled wryly, and continued: "Steering engine room's flooded; ventilator cowl on deck was ripped loose by seas an hour ago; engine's running all right under water, though. Nobody has gone overboard except Pay's little French bull, poor fellow. Some ports in the forward crew's compartment are cracked; have to keep the watch bailing out down there about once an hour. Whaleboat's been smashed up a little, but



Photograph International Newsreel

THE DESTROYER READY TO STING WHILE AT FULL SPEED

The anchors, which sometimes prove such life-savers to a destroyer, are here shown "catted," which is Naval parlance for "pulled up on the deck and secured." The bow gun is trained on a target and ready to fire.



Official Photograph, U. S. Navy

OFF TO SEA

He is wearing the Navy's blue for the first time and evidently is happy about it. In less than six months he'll be well filled out and as "hard as nails."

is fast now. Everything else has been secured.

"Barometer's still falling, now 29.28. Wind and sea are hauling around; wind's about a force eight or nine and has gone from southeast to east; probably will continue the circle. Sea has been from southeast, but is hauling east. You can expect a nasty roll before long. Clinometer in the emergency cabin'll tell you how much we roll. If we roll more than 50 degrees, slow down, head up into the sea, and call me.

"Watch has been relieved. Captain's in the emergency cabin. Johnston and the Paymaster are playing dead in their rooms. Atkins seems to be all right. Got everything?"

"I relieve you, sir." I was grinning feebly.

The Exec. looked at me keenly. "Atta boy!" he laughed, slapping me heartily on the shoulder. "Well, guess I'll turn in, then." He withdrew his head from the canopy.

I turned out the light over the chart and, gaining the lee rail, braced myself against the ship's lurching, waiting for my eyes to become accustomed to the darkness. *So we were going to have a nasty roll before long!* Seas were breaking regularly over the forecastle and romping aft to the bridge breakwater. Spray flew aft in stinging sheets, as we drove on, and the salt froze on my face.



Official Photograph, U. S. Navy

DECK LAUNDRY

These boys are making a bucket serve as a washtub and their hands as a board, but the larger Naval vessels now maintain laundries, at which the men can have their clothes washed for a nominal sum.

On the bridge the helmsman and quartermaster were able to stand their watch; the messenger and two lookouts were dizzily holding on, too sick to be of use.

Down below, in the steaming fireroom, I could picture the watch gripping desperately at anything, as they regulated the burners which supplied oil to the boilers.

In the engine rooms I thought of the watch sliding about, as they governed the racing turbines, on floors wet with bilge water, which sloshed up as the ship tossed and rolled (see, also, page 440).

THE GRAY MORNING OF OUR SECOND DAY

The night lightened slowly to a leaden, freezing dawn. I looked out over the gray expanse of waters. The incessant rolling and pitching was wearing down my physical endurance.

At 8, as Atkins came up on the bridge to relieve me, the K * * * drove into a hurtling, massive sea. The long hull quivered and trembled, and as our fore-castle lifted from tons of rolling water, a cross-sea caught the bow. Under the im-

pact, it seemed to me that the bridge was rolling from under my feet, as the ship heeled over. From below decks there was a crash of broken crockery and a sliding shock of some heavy weight cast loose.

Slowly the ship came to a stop in her roll, and then whipped back to vertical and over the other way. But the opposite roll was not so great, and, as the water rushed and swirled off the decks forward and aft, I fought my way to the wheel. The ship's head had been thrown forty degrees to the right of the course, and the K * * * was rolling heavily, with her beam now to the sea.

"Where is he?" I heard some one with a gruff voice shouting hoarsely.

LASSOING A BUCKING SAFE

"Mr. Hall!" It was Reilly, the chief boatswain's mate. Shirtless and hatless, his hair tousled, Reilly came toward me hand-over-hand on the bridge railing. "Mr. Page says to slow down and head up into the sea. The Paymaster's safe is cast loose!"



"TAKING A REEF"

Wide World Photos

Men do many things at sea that they never did at home, including the mending of torn garments. This open-air tailor shop on the deck of a destroyer appears to be doing a "while-you-wait" business.

In a quick leap I reached the annunciators and rang up one-third speed, directing the helmsman to put on full left rudder. As we hauled around laboriously, I swallowed; my knees felt a trifle shaky. The safe, which was in the wardroom, had been lashed. Evidently the heavy roll had snapped the lashings. That must have been the shock of heavy weight I had felt so plainly.

I bethought myself to inform the Captain; but the Captain was not in the emergency cabin. I sent the scared and seasick messenger to tell him, then turned the watch over to Atkins.

Anxiously I hurried below. To have this ton-and-a-half juggernaut sliding and crashing against the steel sides of little better than eggshell thickness was threatening, serious.

In the passageway to the wardroom a big form crowded past me.

It was Page.

"Just about got her!" he shouted. On his arm was a coil of heavy line. As he stepped into the doorway the ship rolled heavily; a warning yell came from husky throats. I had a vision of a black object sliding and battering past the door, and then Page disappeared. A groan, a splintering of wood, glass, and metal, and then a rush of men. I gained the doorway and saw a handful of burly men straining at the safe, hauling it away from the metal sideboard into which it had crashed.

"Reilly!" Page yelled. "Lasso 'er! Lash it between the stanchions in the middle of the wardroom!"

Struggling and gasping, the men carried out Page's directions. I jumped in to help, and found the Captain and Page shoulder to shoulder with me. The line which Page had brought with him soon inclosed the safe, the mass of broken chairs, the twisted metal dining table, and the splintered victrola cabinet.



Official Photograph, U. S. Navy

THE SKY-PILOT'S DAY

The ship's band furnishes music for the church services conducted on board. The church pennant, to be seen at the left (blue cross on a white field), is flown above the national emblem during divine services. This is the only flag that enjoys such distinction.

I heard Page's voice in my ear: "Damned thing nearly went through the side; the starboard transom got the first dent. Don't see why the Pay. couldn't invent a lighter box to carry his cash in."

I gazed long at the buckled and splintered transom, driven in almost to the ship's side, and shuddered.

The men completed their work. I wandered to my stateroom. Tugging and pulling at my wet clothing, I finally threw myself upon my bunk, drifting off to exhausted slumber.

A VISIT TO THE GALLEY FOR REENFORCEMENTS

When I awoke the dull afternoon light showed me by my wrist watch it was almost 1 o'clock. I decided to get on deck, fill up with air, and also pay a visit to the galley. The sea and wind were from almost dead astern now, picking us up and lifting us along viciously. At times the seas romped up and swarmed over the after decks, and at other moments a speeding green mountain got under the

counter and careened us over until it seemed to me our foretopmast would dip water.

After reënforcements of a hot beef sandwich and a cup of steaming "Java," I clambered up to the bridge. Johnston was on watch and greeted me with a feeble wave.

I returned the salute. "How's she steaming, John?"

"Rotten, thanks. Boilers are salted up badly—and so am I. I can't imagine what it was I ate before we left 'Bosting,' but I feel inside like a wriggly eel. No thanks to the Exec., either, for putting me on watch."

"Where's the Exec. now?"

"In the emergency cabin with the Old Man, dopping out where we are."

WE CHANGE OUR COURSE

I looked through one of the emergency cabin ports. The Captain, bending over the chart desk, looked up and proposed something to Page. The latter agreed and the Captain stepped out of the cabin.



Official Photograph, U. S. Navy

SEAPLANE AND DESTROYER

The narrowness of the destroyer is well illustrated by the fact that the wings of the seaplane reach entirely across its deck and extend to the vessel alongside.

"Johnston, change course to west. You may have to slow speed a little, for the new course'll bring the sea on our bow. By dusk we may see Nantucket Shoals Lightship, so keep your watch alert."

As the K * * * was headed west, I stepped aft and into the emergency cabin.

"How's she steaming, Mr. Page?"

"Pretty rough, Hall. Picked up speed to ten knots at 9 o'clock this morning, and that helps some. Hope the Captain slows down on the new course or we'll get an awful hammering. Not much sleep the rest of the trip, I guess."

As we approached our new course, the K * * * 's laboring increased. By the time we were west by compass, we were

alternately lifted high and rolled over by each crested sea, and then dropped like a pile driver into the following canyon. When we struck, the hull quivered and strained to rise under the weight of water which flooded the forecastle. It was on the third crash that a splintering and sliding from overhead occurred, and our radio aërials, sparking from an outgoing message, snapped and fell from their waving heights to the upper decks.

"No one can repair that in weather like this," Page remarked laconically. "No chance of aid now from radio compass bearings."

I stepped out on the bridge and saw the radioman who had been on watch strip



Official Photograph, U. S. Navy

"CHOW"

But one not versed in the slang of the sea may wonder what it is all about when he hears a table lined with gobs calling for "Java" (coffee), "slum" (stew), "red-eye" (catsup), "sweet sand" (sugar), and "shiverin' Liz" (gelatine).

away the broken spreaders and twisted antennæ. A wet flake dropping on my nose broke my somber train of thought. I looked up. It was snowing again, and over toward the west the sky was black. A rumble of thunder came to my ears, and off to the southwest a thin fork of lightning shot down to the horizon.

"Will you look at that!" I thought. "All the weathers together! More—and yet more."

Wondering what was coming next, I sought my restless bunk for a possible short nap before my four-to-eight watch.

When I came up on the bridge at eight bells, the snowstorm was being driven by a vigorous, freshening, northwest wind. The Captain was on the bridge.

"Haven't seen a thing of Nantucket yet, Hall." Captain Welles' lips were drawn. "Page thinks we'd better take soundings at half-hourly intervals, so

start them at 5, in case we don't see the lightship. Let me know when you have one or two."

After I had taken over the watch, I peered out into the thick veil. We were walled in almost completely, wallowing and careening under the intensified rush of seas which leaped out from the white drapery and vanished into the opposite curtain of snow.

By two bells it was dark. Nothing had been sighted, so I sent for Stearn. Soundings began to come up regularly. The light in the emergency cabin was suddenly switched on. Startled by its comparative glare, I peered in through one of the open ports. The Exec. was bracing himself and checking over the soundings.

"Forty-five fathoms, fine gray sand bottom, was the last, Stearn?"

"Yes, sir. And this one is 36 fathoms, same bottom."



Official Photograph, U. S. Navy

"PEELIN' SPUDS"

These young men should be well trained in domestic arts as well as in the ways of war. They get lots of this kind of experience, for the Navy is a great potato market.

Page laid down the soundings, distance made good, and course steered, on a strip of transparent paper and slid it over the chart. At last he found chart soundings to correspond with those taken.

"H-m-m-m. Puts us fifteen miles south of Nantucket Shoals Lightship, roughly, eh? Let me see—24 hours should put us off Cape Henry, if we steer about 236 true and make fifteen knots in this sea. Tell Mr. Hall I want him. Oh, you there, Hall! Will you send a messenger to the Captain—ask him to please step up here?"

The Captain came on the bridge, checked over the chart navigation, ordered the course changed and speed increased to fifteen knots, cautioned all hands to keep

alert, and then went below decks again to his cabin. We ground on, whipped and buffeted by seas which, because of our increased speed, seemed to rush at us with anger.

OUR THIRD DAY OUT

It was not until the dawn of our third day at sea slowly unveiled the sky that the gale had lightened its intensity. I was on deck again with the four-to-eight watch. Page, who had slept in the emergency cabin, called for the messenger. I stuck my head in at the lee port of the cabin and managed a grin. "Helmsman, quartermaster and I are the only ones on our feet, sir."



Official Photograph, U. S. Navy

"UP AND OVER"

Something is always being scraped and painted aboard a man-of-war. The peculiar seat used by these sailors who are engaged in painting the smokestack is known as a "bosun's chair."

Page smiled back. "Well, I'm coming out to look around."

He gained the lee rail and I joined him. It had stopped snowing before daylight, but the skies were heavily overcast and the seas were rolling high, even to the horizon.

"Don't think we'll see the sun to-day, do you, sir?"

The Exec. slanted his eyes upward. The wind was dying down but slightly, leaving little prospect of dispelling the snow-laden clouds massed overhead.

"No. We'll have no sights and probably won't see anything to help us until to-night. Then, by George, we'll have to pray that our dead-reckoning line is right, our seasick helmsmen haven't thrown us more than ten miles off that line, the engines have been pushing us according to Hoyle, and the Virginia Cape lighthouse keepers don't have apoplexy about eight bells."

He paused reflectively, and then went on:

"This is the first time I've ever been this long without seeing sun, moon or stars, or some light, or having a radio compass bearing. Six hundred miles around corners without some reassuring touch is my idea of a whale of a good start for the southern cruise."

"Check!" said I, with feeling.

FEELING OUT THE SHOAL ATLANTIC SHELF

Despite the fact that the wind was relaxing its vigor, the sea was still remorselessly rushing at us, but from a different direction, having hauled back around to nearly astern, pushing us along.

The air was penetrating to the marrow. It continued in this way throughout the daylight hours. About noon the monotony was broken when an east-bound tramp was sighted to the southward, her cumbrous bulk



Official Photograph, U. S. Navy

OFF WATCH

Although there is much to be done at sea, there is still some leisure time, when the weather's fair and the sea calm. A part of the skipper's gig may be seen a little to the right and above the middle of the picture.

tossing back walls of foaming white. As dusk began to settle, I came up to relieve Johnston.

"Captain says to have soundings taken every half hour, Kewpie. We're getting in touch with the bottom again, but no one knows whether we're steamin' for Chesapeake Bay or the Panama Canal. Captain's inside the emergency cabin now, plotting the last batch of soundings, and he's sure worried. When you land on the beach, be sure to let me know, will you?"

I braced myself near the compass and tried to see ahead. The glass was covered with frozen spray, so I gripped hard at the emergency cabin railing and finally

reached the lee wing of the bridge, peering out into the dusk. The K * * * was slashing and swashing along doggedly. Worn as I was by the continual physical punishment, my nerves thoroughly shaken by the pounding effect of the seas, I let my mind dwell on Johnston's jocular remark.

When, at 7 o'clock, the sounding taken showed 56 fathoms, gray sand, I hurried to the emergency cabin. Page was plotting the sounding. The Captain was sitting on the transom, his elbows on the chart desk, chin cupped in hands, watching the results.

"Can't tell much yet, Captain," Page



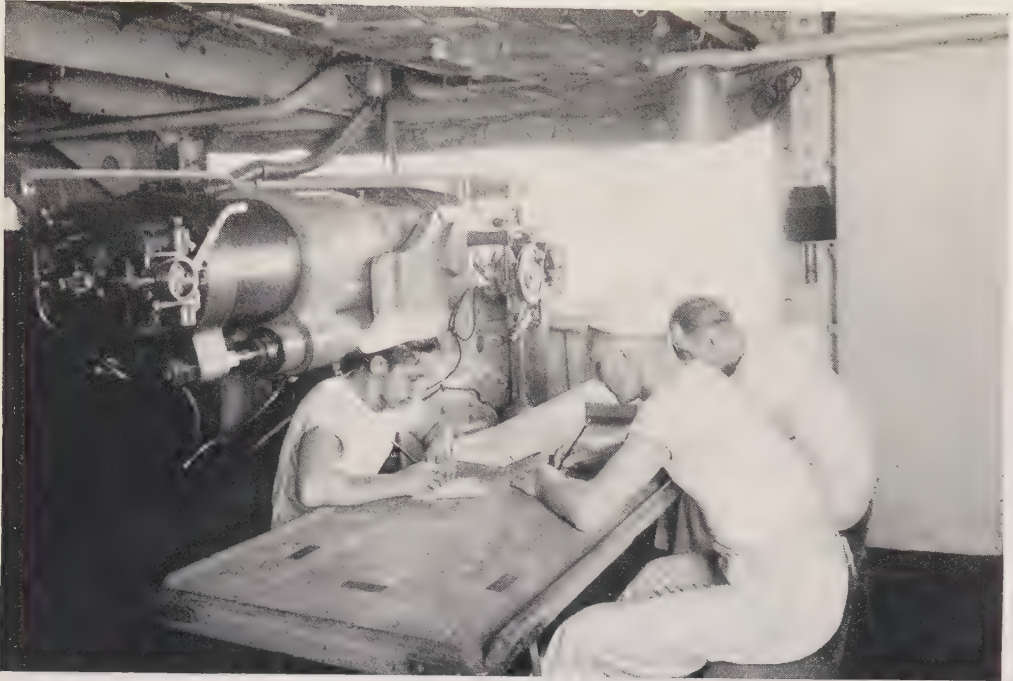
PALS



Official Photographs, U. S. Navy

A COUPLE OF KIDS

The young "gob" is playing nurse to the ship's mascot, who seems to enjoy being a bottle-fed baby.



Official Photograph, U. S. Navy

WHERE SEA TALES ARE MADE

These men are writing on a mess table which hooks on to the ceiling when not in use, and is thus completely out of the way. One thing a sailor never lacks is interesting news for his letters home.

remarked. "That's sure enough. Another sounding or two may help us. If we have made anywhere near our speed or course, we ought to see either Cape Henry or Cape Charles. Light by eight o'clock."

As soon as Atkins had relieved me at eight bells, I wrote my log for the watch and then went into the emergency cabin.

"It's about 8:15, Page." The Captain was speaking. "The last sounding was 42 fathoms, and the bottom makes me believe we're south of the Capes, about an hour behind in distance. Think we'll be all right if we change course to northwest. Ought to sight Cape Henry or Buoy 2CB in half an hour."

Stearn, who had stuck his head in the cabin doorway in time to hear the Captain's last words, grabbed a telescope out of the case. I followed him out on the bridge and watched him as, clinging to a bridge awning stanchion, he began a determined search of the horizon for lights, pausing only at intervals to wipe the spray

off the lens. As he concentrated on his search, he looked up and whistled.

DANGER SIGNS AHEAD

"Sir, there's a heavy haze hanging low on the water toward the west. Can't pick up much."

The Captain, who had come up beside me, was galvanized into action. "Atkins, we've got to double our lookouts! Pick out a good man to send aloft, too, with a pair of binoculars. He may be able to see over the haze. It'll be heavy work up there, hanging on, so he's got to be a husky. I'll slow down soon, unless we sight something."

Here was my chance for proving myself, I thought.

"Captain, how about me for a foretop lookout?"

"Certainly, Hall! By all means!" The Captain, seemingly pleased, slung a pair of binoculars around my neck. I removed my cap and started precipitately for the flying bridge.

"Here, Hall"—Page was pulling off his



© Underwood & Underwood

SEAMEN THREE

Seagoing pets are often trained to do all kinds of tricks and stunts, their sailor friends devoting many an hour to their proper education.

woolen gloves—"take these. It will be pretty cool up there."

"Be careful now!" was the Captain's final warning.

BREAKING AWAY FROM THE ODIUM OF "MAKEE LEARN"

As I started my ascent I was reminded that I should be cautious. The steel ladder rungs were glazed with ice and, my feet slipping, I rapped both shins smartly against the next higher rung. The rungs were treacherous to the grip; it was all I could do to hang on by my hands. I began all over again by wrapping my arms around the uprights and bracing my legs as I went up slowly, step by step.

As I went higher, the swaying of the long mast, as the ship lurched drunkenly, caused me to look down. Thirty feet below I could see the light from the emergency cabin. The glare of the running lights revealed the spreading phosphorescence on either bow. Close underfoot, the white masthead light offered nearer companionship.

Climbing on, my arms chilling and stiffening, I pushed head and shoulders up through the trapdoor in the crow's nest and in another moment was inside. Closing the door underfoot, I began searching with my naked eyes all around where I imagined the horizon should be. I could not see the dividing line between the sea and the heavens.

The weaving of the mast caused me acute annoyance when the ship pitched and lurched; the shock of the crashing water came up through my

feet, vibrating and shaking the tiny crow's nest as if it were a rat in the jaws of a terrier.

I could see nothing for a time, and, pulling off the gloves, I adjusted the binoculars to my eyes, searching where I thought the horizon should be, from beam to beam, occasionally wheeling to look astern. The cold wind whistled through the crow's nest, chilling me and stinging tears into my eyes. It was as if I were in a world by myself up there—a cold, misty, stinging, waving world. I looked over the edge of the crow's nest to get a comforting touch in the way of seeing the ship's lights beneath.

As I looked up again, a tiny light

flashed somewhere there, close on the starboard bow. I caught my breath and tried to focus my eyes on the exact bearing, as the mast weaved over and back. It came again, but was lost in the foglike haze. I couldn't afford to wait. Fumbling with numbed fingers for the bell to the bridge, I pushed it, then yelled down the voice tube.

"Captain there? . . . Captain, there's a flashing white light almost broad on the starboard bow!"

The query shot back, "A flashing light?"

That was all I heard. I rang the bell again, but could get no reply. The ship seemed to be continuing her course and speed. If that light were Cape Henry, we were heading for the shoal shelf off Virginia Beach! I looked again for the light and located it; it seemed nearer, brighter. Two short flashes and then a long flash—Cape Henry! I pushed the bridge bell frantically and shouted down the voice tube. No answer. I tore open the trapdoor and, half sliding, half falling, started the slippery descent. As I reached the masthead light, clouds of white smoke began rolling from the fireroom stacks. The acrid fumes gagged and blinded me, but I reached the flying bridge.

There I paused for just a moment, for down on the bridge all was darkness; there were sounds of men scrambling about; orders being shouted. Above me, the masthead light suddenly flickered out. I caught the words of some one passing under my feet—"Lost oil suction in the firerooms!"



Official Photograph, U. S. Navy

SMILING AT A SCOLD

When the fleet returns from a southern cruise the decks often look like a menagerie in transit. Many small tropical animals and birds are brought back, but monkeys and parrots predominate.

I slid down to the bridge and in the darkness found the Captain.

"That's Cape Henry, Captain!"

ENGINES FAIL, ANCHOR DRAGS

"What? Oh, yes, Hall! Fireroom has lost oil suction—no power. Oil barge at Boston must have had some water in that lot she gave us, so we're being washed and drifted along onto the beach just now."

"Look there, Captain!" I pointed.

The haze had thinned for a moment and Cape Henry Light was plainly visible.

Gripping my arm, the Captain shouted in my ear, "Anchor, Hall! Get Reilly—"



Official Photograph, U. S. Navy

READY FOR A TORPEDO BROADSIDE (SEE, ALSO, PAGE 458)

I struck out for the bridge ladder, spilling over two of the scared watch.

"Reilly! Reilly!" I shouted, as I landed on the main deck. The big boatswain's mate was a welcome figure, as he stood there at the foot of the bridge ladder, an oil lantern in his hand. "Here, sir!"

"We're going to anchor!"

Clinging to the lifelines on the fore-castle, we fought our way to the eyes of the ship. As the K * * * rolled and staggered, we cast off the lashings, drove out the stopper, released the compressor, and in but a moment—no more—the star-board anchor jumped off the billboard, the chain rattling as it ran and throwing a whirl of spray off the unreeling wild cat. A roar through a megaphone came from the bridge.

"Veer to 90 fathoms!"

As the chain took the strain, the ship hauled around, head to sea, pulling and heaving mightily on the thin links of steel. Treacherously the anchor slipped, caught for a fraction of a minute, only to be

yanked clear by the surging strain of the ship.

I secured the chain and returned to the bridge. Johnston was there, too.

"Be ready in about ten minutes, I think, Captain," he was reporting.

The Captain was unmindful of the engineer's words. He was watching Page check the bearing of Cape Henry Light. A hail from the fore-castle leadsman, "Ship's dragging, sir!" verified his suspicion. Only then did the Captain reply.

"Ten minutes. H-m-m! We're dragging to the beach. Atkins, you here? Have all men on deck! Close all water-tight doors!"

A TOUCH OF SEAMANSHIP

By the light of oil lanterns I saw men pouring out of the hatches from the living compartments, sleepily cursing. They listened quietly to Atkins' sharp, brief commands; then went swiftly to their assigned stations. "The other anchor, Captain?" Page was asking.



Official Photograph, U. S. Navy

BECLOUDING THE ISSUE

Destroyers are useful not only as convoy and patrol boats, but also play an important rôle in actual "battle-fleet" engagements. There they launch their torpedoes at the larger ships of the line and dart away under cover of a smoke screen. Notice the scout planes flying above the smoke and thus enabling their fleet to see beyond the dense screen put up by the destroyers.

The Captain nodded. "Hall! Get Reilly to help you."

I reached the forecastle, Reilly faithfully at my heels. In a trice the port anchor was over, and as the strain was taken off the dragging starboard anchor, the port anchor seemed to grip and hold at the 30-fathom mark. The ship swung off on its new lead of anchor chain, and as this happened I eased the port chain slowly out of the hawsepipe.

Desperately we clung on, as the bow was pitched high, vibrating the chains till they sang taut, and then crashed down. As the strain took on both chains, the forecastle dug into the huge waves, carrying us under. The tearing force of the green water wrenched and twisted our arms. After what seemed to be an eternity, we again drew in free air.

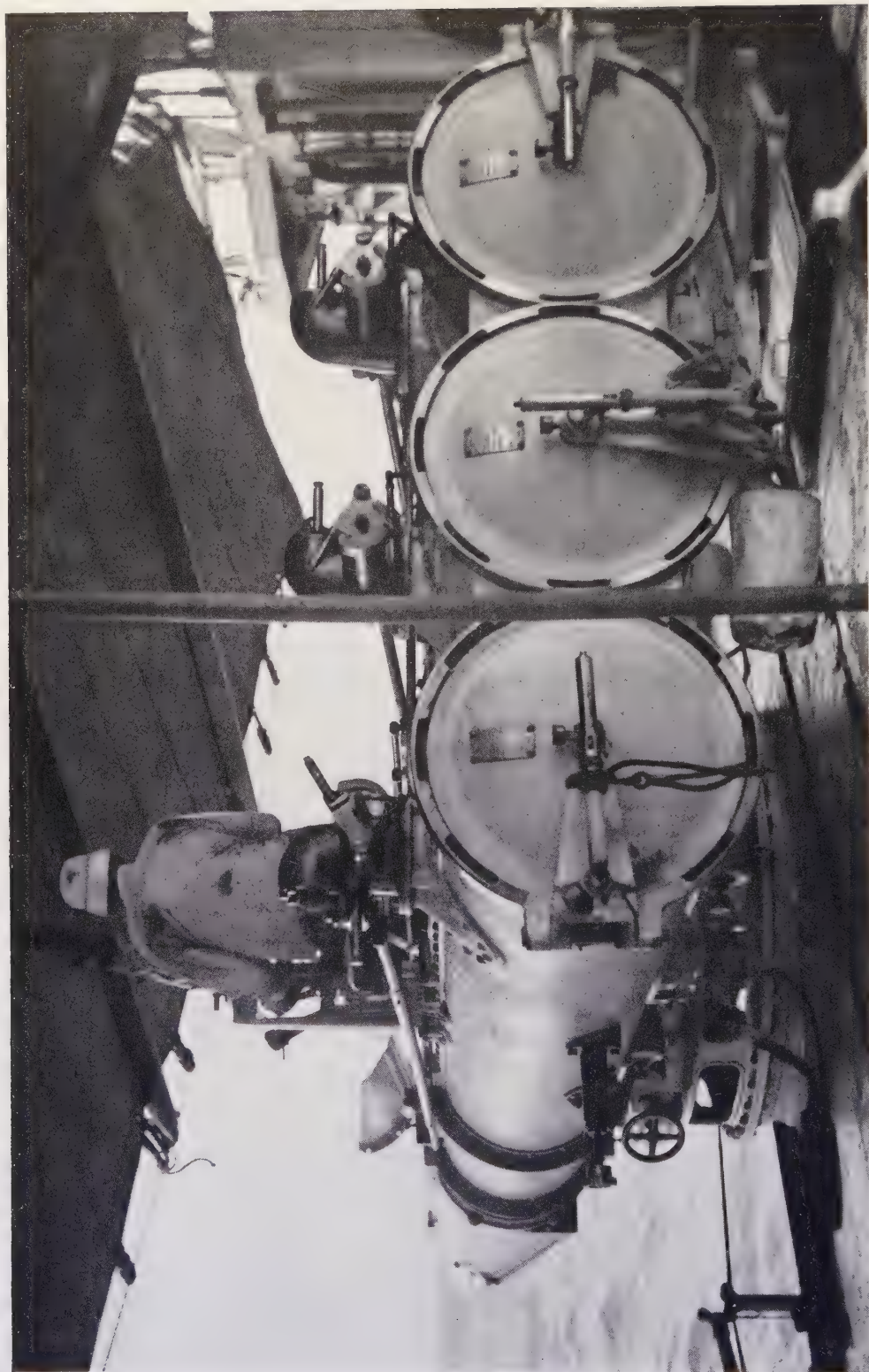
"Better get out of here, Mr. Hall!" Reilly sang out, choking and sputtering.

Choosing our moment, we dashed aft, holding grimly to the lee lifeline. Aft the break of the forecastle we stopped for breath.

Farther aft, the men not on watch were standing ready in life jackets around the big life rafts. On the fantail, Stearn was heaving a hand-lead; the water had become too shallow to bother with the sounding machine. Calmly, methodically, as if it were merely a drill, he dropped the lead over the side, plumbing the depth and noting the mark in his hand by a flickering lantern held by a scared youth. The result was transmitted to the bridge by voice tube.

GETTING THE LIFE-GIVING OIL TO FLOW

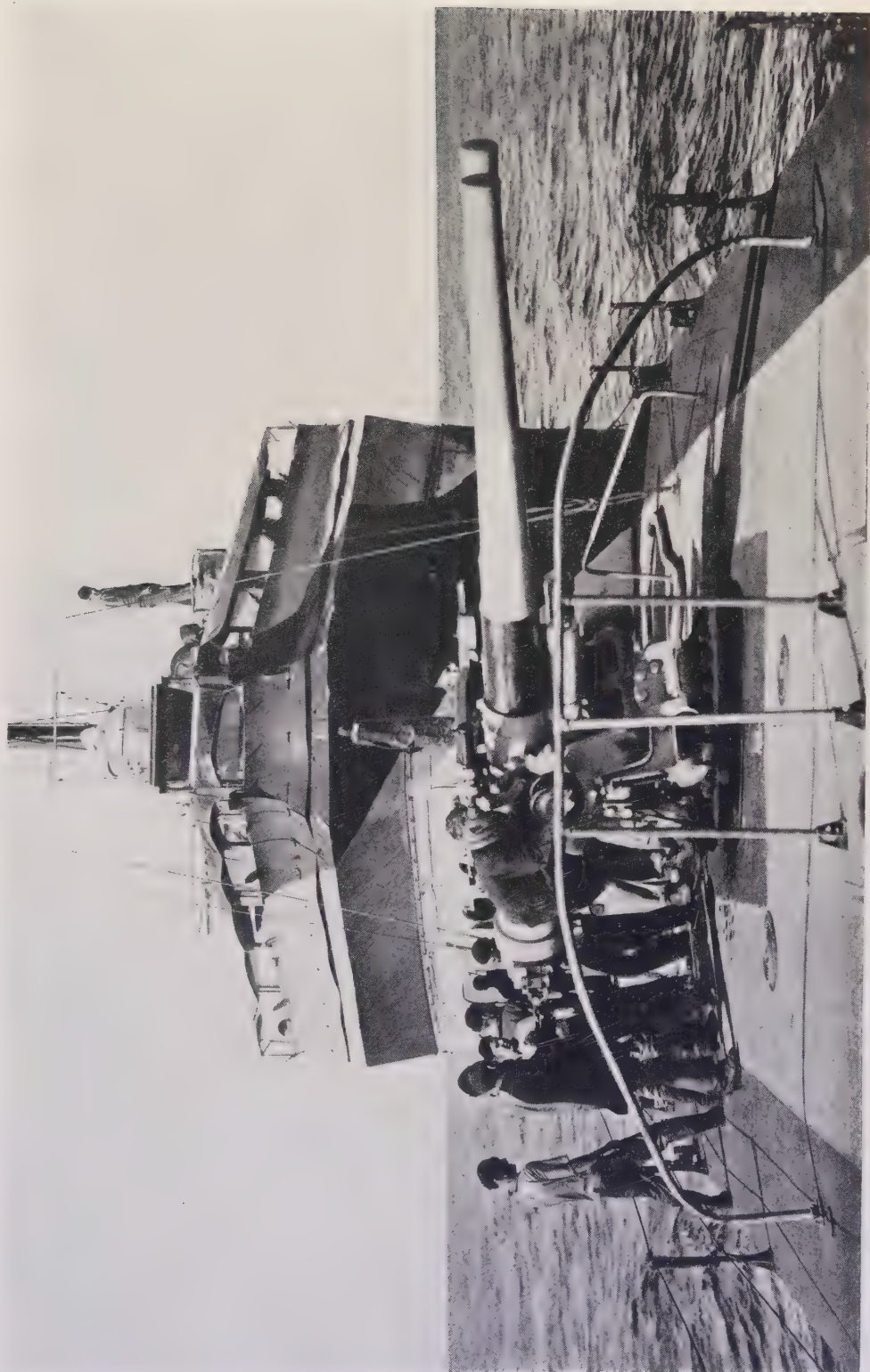
Down below, in the steaming fireroom, men splashed with fuel oil were fighting to get the life-giving oil to the boilers. The feeble light of the auxiliary lamps



Pacific and Atlantic Photos, Inc.

TRIPLETS OF DEFENSE

While a destroyer carries a few guns for use against submarines and other destroyers, her real batteries are her torpedo tubes. These most effective weapons send the "silver fish," as the torpedoes came to be known during the World War, off on their course of destruction against the great battleships (see, also, illustration, page 456, and text, page 467).



Official Photograph, U. S. Navy

GUN DRILL

This crew is engaged in sighting their "twin mount," as the pair of guns is known. The latest destroyers' batteries are equipped with a shield to protect the gunners from waves and spray (see illustration, page 442).



Official Photograph, U. S. Navy

SIGHTING DUMMY TARGETS (SEE ILLUSTRATION ON OPPOSITE PAGE)

This deck work constitutes an important part of the gunnery training of young officers. The officer looks through the reverse end of his binoculars to lend distance to the view of the targets.

cast ghostly shadows against the shining boiler fronts. Johnston, his hair caked, his eyes almost blinded by a faulty burner that had sprayed him with oil, hammered the gratings with a monkey wrench.

"Not a man of you leaves this fire-room—do you get me? We've got to pick up suction! Cut in all burners! Cut in all tanks! Let 'er go! Water or oil—something's got to start!"

As if his determination had struck fire from flint, a roar of flame rushed through the burners of both boiler furnaces. Oil was coming—oil mixed with water—for the roaring was punctuated with fizzes, and the white smoke from the mixed oil and water backed out from the boilers, gagging and choking the men frantically trying to manipulate the burners.

Suddenly, in the midst of this mêlée, the ship shook from end to end, straining at every rivet, quivering under a terrific shock.

"Hold it, boys!" Johnston yelled, white beneath the oil and grime on his face. "Never mind that! We'll get her yet!"

The oil sputtered and fizzed, but the fires swept under and over the boiler tubes. Steam gauges began rushing up. Forced draft blowers commenced humming in a low, encouraging tone. As the steam gauges registered 150 pounds, the engine rooms cut in on the generators and the ship was once more aglow with light.

On the bridge the shock had turned our faces white under the cover of darkness. I had returned there, feeling a strange sense of unreality. The weird sensation of helplessness was increased by the black of the night, the screeching of the wind, the ghostly wash and spray of the waves, the incessant roll of the ship, the uncanny light of the Cape pointing its finger at us and then withdrawing it suddenly, leaving us to the mercy of the howling dark.

Suddenly the boilers were torching red flames high above the tops of the stacks—this due, as I learned afterward, to the sudden heat applied to the accumulated oil in the bottom of the furnaces. A moment later the ship was shaken from stem to stern, as the boilers started "panting."



Official Photograph, U. S. Navy

SPOTTING PRACTICE

Training in spotting the fall of shot is given officers through the medium of diminutive targets and splashes set up on deck at distances which through binoculars appear in proportion to the actual distances over the water when real targets replace the models.

"They've got suction!" yelled the Captain in my ear. "Page, ring up full speed ahead! When the engines have enough steam, they'll answer. Don't know whether we've hit or not, but we'll get out of here, *pronto!*"

Atkins shouted out of the darkness, "Can't find a thing wrong, sir! All compartments are tight!"

Almost simultaneously came Stearn, clambering up the bridge ladder. "Captain, we're draggin' again!" he cried. "We stopped for about five minutes, but the last sounding was eight fathoms. Puts us close to the bottom in this sea!"

All at once the lights came on.

"We're going ahead now, sir!" Johnston, wild of appearance, was on the bridge, reporting to the Captain.

"What? Good! Fine! Here, Hall!" Captain Welles rushed toward me. I was tingling with excitement. "See that those

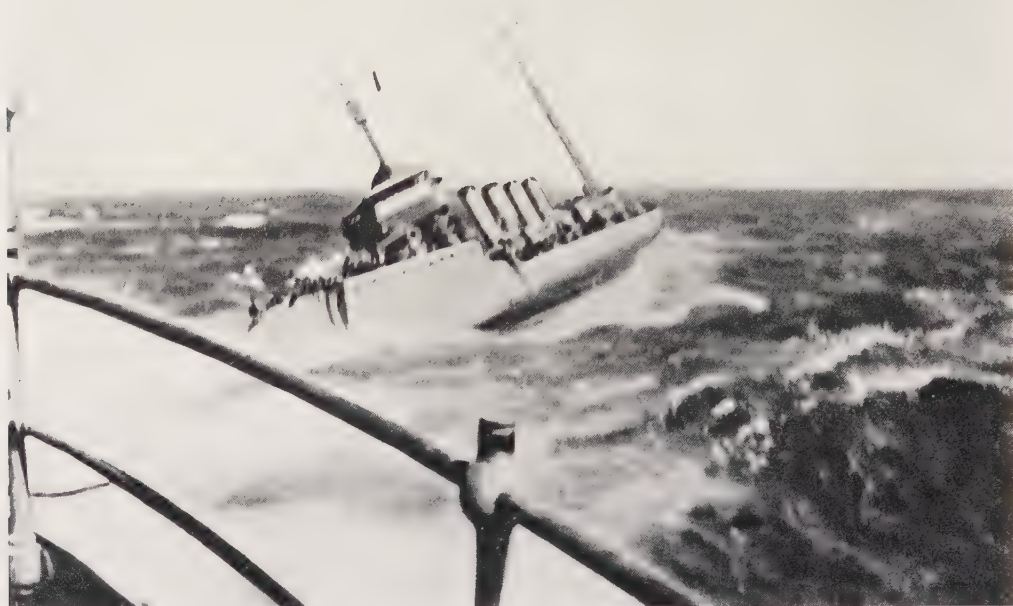
anchor chains are secured as tightly as they can be. I'm going to drag the anchors until we're in deeper water!"

WHAT CAUSED THE HEART-SICKENING SHOCK

I was on the forecastle in a moment. Afterward I wondered how I had ever been so slow getting there. Reilly, the faithful, was with me, and as we started to put double stoppers on the chain, he turned to me.

"Port chain's gone, Mr. Hall. Snapped her links just at the 45-fathom shot. She musta held—Stearn says we held until that big crash. By the great saints! That was what the crash was! Chain surged and cracked under the strain, and when she went, the whole ship jarred like she had hit the bottom!"

We worked on in silence for a moment, both thinking what might have happened if the port anchor hadn't held.



Official Photograph, U. S. Navy

FUELING AT SEA

The use of oil as a fuel for warships has greatly increased their cruising radius and hence their effectiveness. It is now possible to fuel a destroyer in mid-ocean by means of a hose connection between it and the fuel ship. To accomplish this transfer in rough water is no easy task and calls for consummate seamanship.

To the bridge I sang out, "All secure, sir!"

"Very well!" came back by megaphone. "Stand clear! We're going ahead!"

As the ship forged ahead, the starboard chain tautened, then surged. Slowly the ship dragged out to deeper water, where the lone remaining anchor was weighed and catted, and we picked our way carefully on past Buoy 2CB, and shortly after four bells rounded the Tail of the Shoe Buoy.

ANOTHER SHOCK AT THE RENDEZVOUS

Inside the Capes the haze was lighter. The anchor lights of our squadron and those of Squadron Fourteen danced dimly over in Lynnhaven Roads. It was but a matter of minutes before we were threading our way among our mates, signaling the flagship for instructions.

The reply came sharply by blinker:

"Anchor 300 yards bearing 90° from the S * * *. Fleet sails at 0200 (2 a. m.) to-morrow for Guantánamo. Commanding officer report aboard immediately."

Three hours, and we, worn and somewhat crippled after our 600-mile battle, were to sail for Cuba! Flooded peak tanks and the steering engine room to be pumped or bailed out, broken port lenses to be blanked off, bent stanchions re-braced, fresh water for the boilers to be made. And every man and officer on board had been under physical strain untold for the past 50-odd hours.

The Captain called a hurried conference of officers on the bridge; then went below to shift into clean uniform for his call on the Squadron Commander.

I went into the emergency cabin. Page was there, talking to Stearn. He turned to me as I entered.

WITH THE FLEET AGAIN AND OFF FOR CUBA

"Well, Hall! Destroyer life may be rough, but it's seldom dull, eh? Come on, let's get below and start cleaning up. Nice little nap, and then you and I will get 'er under way. Others'll be ready to drop in their tracks after making repairs. Oh,

sail ho, for Cuba—
Cuba, *perla del mar!*"

At 2 we were under way. A handful of men and officers moved the K * * * into her position in column, and, with our bodies aching and eyes strained, we slipped along out the entrance to Chesapeake Bay.

Ships were proceeding out of harbor in a night sortie. A dimmed light on the vessel ahead was our only beacon of the fleet's existence. Ahead of us somewhere mine sweepers had cleared a narrow channel for our exit. Destroyers of Squadrons Nine and Fourteen followed out astern of submarines, and were followed in turn by the battleships and supply ships of the Scouting Fleet. The first series of tactics for the Southern cruise was on.

I was no longer acutely aware of the ship's lurching. Spray tossed in my face by the wind served to cool and soothe the wearied feeling which had crept over body and mind.

Once outside the Capes, our division separated, taking up an assigned position in scouting line ahead of the main body of battleships and ships of the train. By 4 o'clock, when I stumbled below, the K * * * was steaming south at 15 knots on the rim of a huge circle, in advance of the fleet main body, which formed the center.

I was awakened before noon by the same talkative quartermaster who had hauled me from my bunk the first memorable night out of Boston. It seems to be a necessary qualification for a quarter-



Official Photograph, U. S. Navy

A CLOSE-UP: OILING SHIP

Fuel oil has almost displaced coal in the Navy. Not only is it more efficient and much more easily handled, but it is so much cleaner than the "black diamonds" that fueling is no longer the fearsome and filthy process it once was (see, also, illustration, page 462).

master—to talk sufficiently, perhaps to no point—until the oncoming watch officer is thoroughly on his feet.

"Only an hour or two from Hatteras, Mr. Hall!" This was what finally awakened me, for the reputation of the Stormy Cape put me on the alert. But what words were these? "Mr. Johnston says the weather's warmer and the sea is getting as flat as a looking-glass."

What, ho! Was Johnston "spoofing" me again, or was fortune about to change for us? After all the constant hammering we had received, could this be possible? Especially off Hatteras! I es-



Official Photograph, U. S. Navy

MAIL, FROM HOME

sayed a puckering whistle, as I swung my feet over the edge of the bunk. By the time I was standing, the whistle had grown to full size and was varied by an attempt at song.

"Hey, Hall!" This roughly, across the passageway, from Atkins' room, which was dark, with curtains drawn. "Don't forget I had the four to eight and need my beauty sleep."

A CLEAR TICKET PAST HATTERAS

In spite of this reproach, my spirits would not down. At the wardroom table, which the carpenter's mate had miraculously contrived to bend and patch into some semblance of its former shape, I could scarcely refrain from humming.

The spirit seemed to be spreading, too; for López, the Filipino mess attendant serving me, was actually "on deck," with his quiet smile, for the first time since we had left Boston Light Vessel.

When I went up on the bridge, Johnston greeted me with a wan smile. Poor devil looked to be all in—probably due to getting his repair work done before sailing. However, he was, as usual, in good humor.

"See what I've left for you!" He swung his arm around the horizon. "Nothing like it, old boy; this is the life! People pay good money for trips like this; and to think, in two more days we'll be in the sunny Caribbean!"

After taking over the watch, I looked out across the waters. The crow's nest of the S * * * was barely visible through binoculars, there, slightly

abaft the port beam. That of the L * * *, as well as the tops of her stacks, I could see on the starboard beam without the aid of my glasses. Nothing else was visible from the ship but the rolling indigo blue below and a tufted blue sky, glarish in the midday sun, overhead. Astern of us some 12 miles, I knew, were the battleships, for we were dead ahead of them, on our part of their surrounding circular screen.

"Well, Hall, how does this strike you?" It was Page, yawning at the moment I turned to him and stretching his arms wide. "By George, this is great! Tomorrow we'll be through the Gulf Stream, and then we'll be changing into whites. What's that!" He pointed at the surface of the water on our starboard bow. "A



Official Photograph, U. S. Navy

GETTING THINGS SHIPSHAPE

So neat and orderly is everything aboard a warship that we have derived the term "shipshape" as a synonym for trim and spotless arrangement. Making the rope coil shown in the picture is known as "flemishing down the boat falls" and is peculiar to a man-of-war.

flying fish? Tell me, old man! Y'know, if it is, we can all have a bath to-day. It is! What? Never heard of that famous old tradition? Sure disaster to take a bath at sea down this way until you've seen a flying fish, I assure you!"

The crew on watch were smiling.

"Think I'll suit the action to the word, Hall. Give me a call about three, will you? Have to catch up sleep some time. Ever navigate any? Get you in practice checking my afternoon sun sight. Might get Stearn to oil up a sextant; but mind you"—this with stern burlesque—"don't take the nav-i-ga-tor's sextant by mistake!" (see page 441).

WE ARE ORDERED INTO ACTION

He started to go down the bridge ladder, but stopped when he saw a messenger running up with a radio blank in his hand.

"No sleep for me; I can see it coming! What is it, messenger?"

He took the outstretched message, scanning it. "Squadron Commander has ordered squadron to assemble on him, Hall.

Smoke-screen attack on the battleships. Work's starting early this year." He handed the slip of paper to me. I verified the details of the message and sent it on to the Captain.

In a moment after the Captain's arrival on the bridge we had increased speed and changed course to intercept the S * * *. There was an air of eager anticipation evident, not only on the bridge, but also about the decks.

Snatches of excited conversation drifted up from the crew engaged in clamping down the decks and from the men scrubbing paintwork. Not all of the attempts to get the K * * * looking shipshape after her strenuous trip could down the man-o'-war's-man scent of a coming engagement with "the enemy."

SETTLING DOWN TO THE WORK OF
THE CRUISE

It was not long before the squadron was formed. The ships farthest away had lighted off extra boilers, and now came up with roaring blowers, slicing the Atlantic clean with their sharp bows and



Pacific and Atlantic Photos, Inc.

SCRAMBLED SIGNALS

One might reasonably wonder what kind of a signal required such a jumble of flags, but all it really denotes is that the flags got wet, for the bluejackets are hanging them up to dry. This is known as "airing the bunting."

leaving it foaming white astern from racing propellers. A flag hoist from the S***, and the ships slid like well-drilled troops into a boxlike formation, with one side open. Circling and maintaining the same relative position in formation, the squadron changed course and sped at 20 knots toward the approaching battleships.

Gongs for general quarters began sounding throughout the squadron. Decks were alive with men donning gas masks. Guns and torpedo tubes were manned, engine rooms and firerooms were being manned to battle complement.

Signal flags raced to the yardarm of the flagship.

"Van divisions, make smoke screen."

As the order was executed, heavy, black billows began rolling from the stacks of our two van divisions nearest the path of the approaching battleships.

"Good screen, Page," Captain Welles remarked, as he put on his gas mask. We were engulfed in the smoke of the ships ahead of us. The gas masks we were wearing for protection against an expected aerial gas attack afforded us relief from the gagging smoke clouds.

A messenger, who had been standing with his ear glued to the voice tube from the radio room, suddenly dashed past me. He touched the Captain's arm and made an emphatic gesture. The radio signal to execute the torpedo attack had come!

The Captain motioned the quartermaster at the wheel to give hard left rudder, and himself rang up full speed ahead to



Official Photograph, U. S. Navy

VISIBLE RADIO

Despite the introduction of radio for Naval communication, the semaphore signal is still an important agency for the transmission of messages between ships within easy "eye-range." The quartermaster in the picture is sending the letter "J."

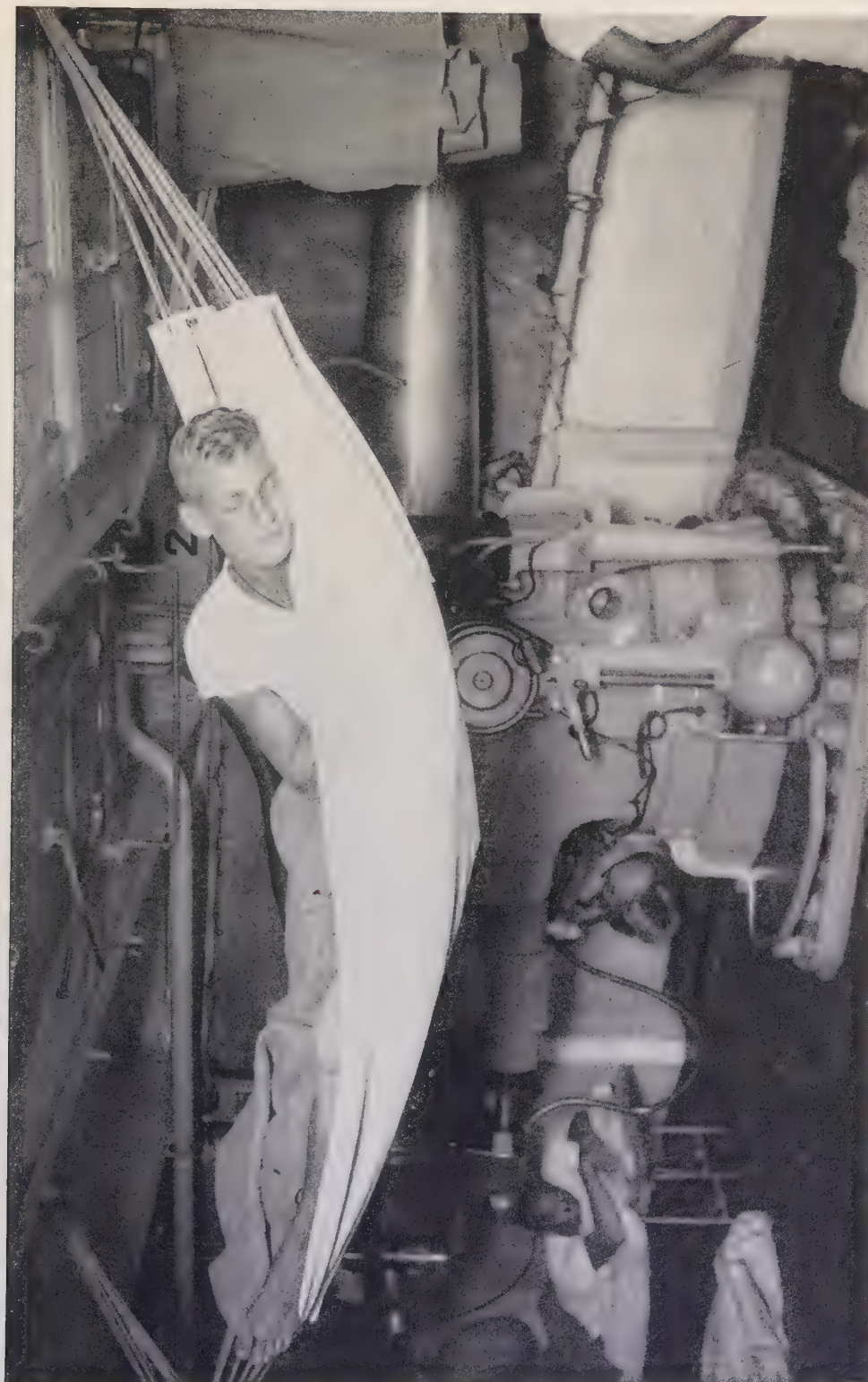
the engine rooms. In a second we were clear of the smoke screen with our mates of the attack division, dashing in column and baring our teeth to the line of battleships, there on our starboard bow, distant 8,000 yards.

Our leader dipped a signal flag. Instantly the division "fired" its broadside. I could almost see the wakes of 36 torpedoes slipping at high speed toward the targets. As airplanes from the fleet swooped at us, the division turned sharply around. The leader's flag again dipped, our other broadside was "fired," and we darted back into the smoke screen.



WASHING DOWN DECKS, A DUTY WHICH THE SAILOR HAS FACETIOUSLY DUBBED "FIELD DAY"

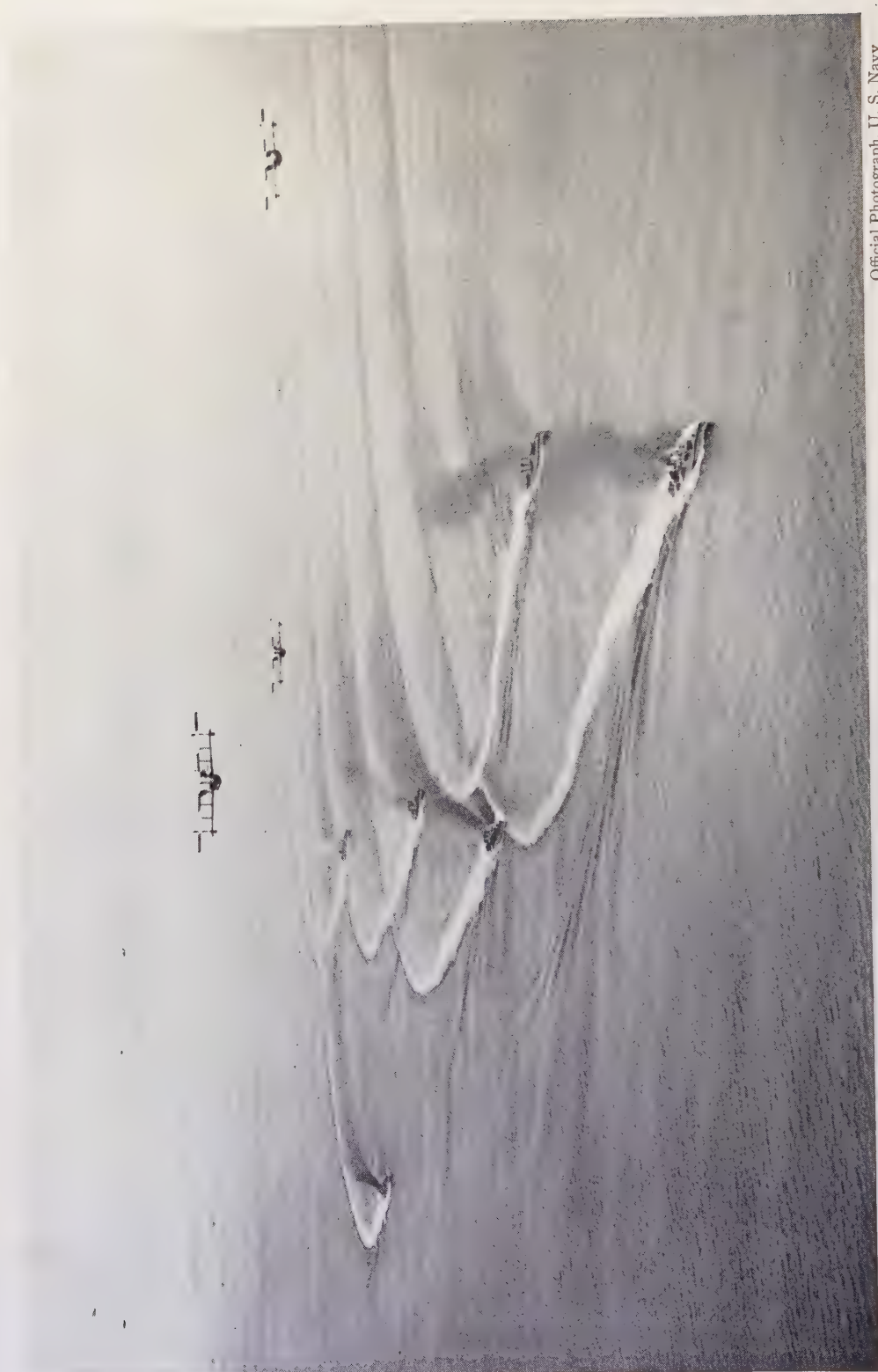
Official Photograph, U. S. Navy



Official Photograph, U. S. Navy

ROCKED IN A HAMMOCK ON THE DEEP

Sleeping quarters for the men on a battleship are very much "à la sardine," because a small space must accommodate many men. Hammocks are swung only about 18 inches apart, and their principal value is that, no matter how badly the ship may roll, the hammocks remain "on an even keel."



Official Photograph, U. S. Navy

CIRCLING INTO LINE WITH NAVY SCOUT PLANES OVERHEAD

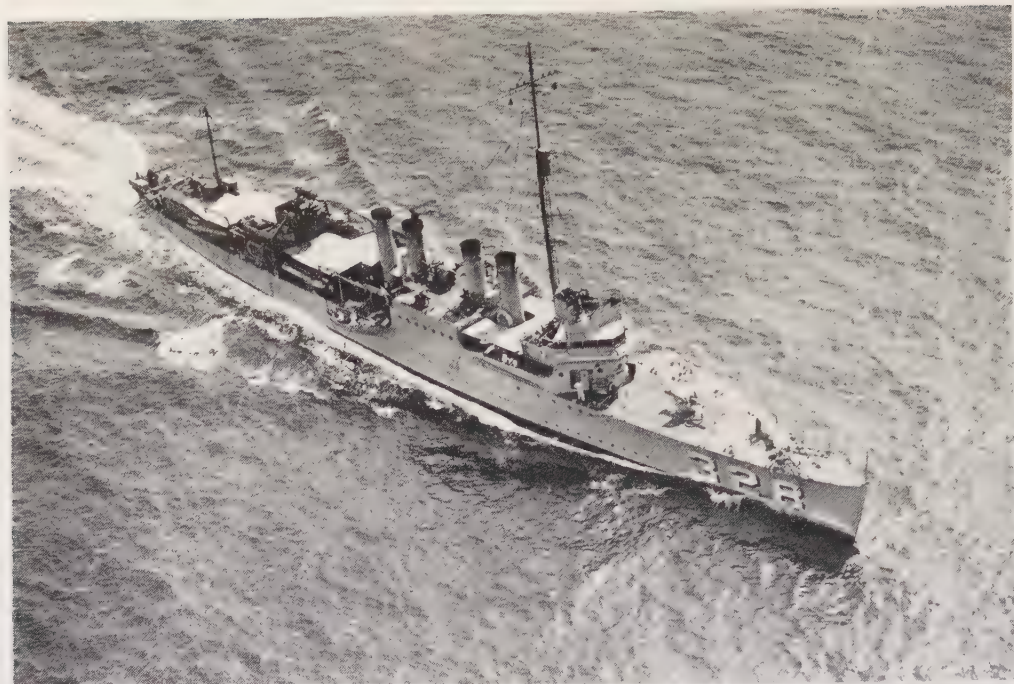
"Circling and maintaining the same relative position in formation, the squadron changed course and sped at 20 knots toward the approaching battleships" (see text, page 467).



Official Photograph, U. S. Navy

DESTROYERS MANEUVERING BEHIND A SMOKE SCREEN

As an order to make a smoke screen is executed, heavy black billows begin rolling from the stacks of the destroyers nearest the path of the battle-ships they are attacking. This enables the other members of the squadron to maneuver for position out of sight of the enemy (see text, page 467).



Official Photograph, U. S. Navy

THE "CORRECTION"

The origin of the destroyer dates back to the time of the Russo-Japanese War. The successes of torpedo boats in that conflict led Naval architects to devise a torpedo-boat destroyer in much the same way that the student in Hugo's "Les Miserables" said: "The Bon Dieu made a mouse. 'Hullo,' he said, 'I've made a mistake?' So he made a cat to correct it."

"Cease present exercises," came by radio from the Fleet Commander, and, as the squadron ceased smoke and assembled on the S * * *, a "Squadron Nine, Well Done," was seen flying at the yardarm of the fleet flagship.

"Old boy's not only generous, but also irreproachably fair," chuckled the Exec.

"Well done" had been passed down on deck by the Captain, and as the ship "secured" from general quarters, a lighter

spirit was evident. Atkins and Johnston, who had joined us on the bridge, noticed this, too. All of us, in fact, were feeling the wholesome effect of that signal. The Captain, actually grinning, stopped in front of us.

"Well, boys, after collarin' Cape Cod, I didn't feel as though we had done so well. But," and he looked behind at the vanishing flagship of the fleet, "we'll make a good ship of her yet!"

Notice of change of address of your GEOGRAPHIC MAGAZINE should be received in the office of the National Geographic Society by the first of the month to affect the following month's issue. For instance, if you desire the address changed for your December number, the Society should be notified of your new address not later than November first.



Photograph by Maynard Owen Williams

LIFE AT BATTLE HARBOR, PORT OF CALL, ON THE LABRADOR COAST FOR THE
RETURNING MACMILLAN ARCTIC EXPEDITION

MACMILLAN IN THE FIELD

Commander Donald B. MacMillan is now engaged in preparing his complete report of the work of the MacMillan Arctic Expedition, under the auspices of the National Geographic Society, with the coöperation of the U. S. Navy. It will be published in an early number of the NATIONAL GEOGRAPHIC MAGAZINE and will be illustrated with photographs made by The Society's staff photographers who were members of the Expedition. With this number a large new map of the Arctic Regions, in six colors, will be issued as a special supplement.

THE safe return of the MacMillan Arctic Expedition will be a source of gratification to every member of the National Geographic Society who has followed the day-by-day news, received by radio, of the work of exploration and scientific research which has been carried on during the summer under the auspices of The Society.

The achievement of the United States Navy flyers in the face of seemingly insuperable obstacles is in itself an epic of Arctic aviation. Lieutenant Commander Byrd, at the request of The Society, has given a bare outline of the work which he and the members of his command in the air have accomplished, but behind each

sentence of that unembroidered, matter-of-fact account lies a story of initiative, skill, and daring worthy of the best traditions of the service to which these pioneers in Arctic flying overland belong.

An unprecedentedly severe season on this side of the Pole, with almost continuous fogs and snowstorms, and with an unexpected assault by icebergs on the anchored amphibian planes in the ordinarily safe harbor of Etah, has prevented the fulfillment of the expedition's plans to establish bases on the edge of the Polar Sea, from which the great "blind spot" on the map, aggregating an area of some million square miles, might be explored. Much has been accomplished for science,



Photograph by Maynard Owen Williams

THE MASTS OF THE "BOWDOIN" SILHOUETTED AGAINST A HIGH PROMONTORY AT BATTLE HARBOR, LABRADOR

however, and it is believed that the knowledge and experience gained by the Navy airmen will fortify the succeeding expeditions with data which will result in the eventual elimination from all maps the word "UNEXPLORED" which now disfigures for eager, acquisitive man that large region lying between Alaska and the North Pole.

PLANES FLEW MORE THAN 6,000 MILES
WITH ONLY ONE FORCED LANDING

Commander Byrd's statement, transmitted by radio to The Society, is as follows:

"My records show that the planes have a total of 75 hours and 50 minutes flying time, which at 80 miles per hour equals 6,066 total miles flown—by NA-1 away from Etah, 2,506 miles; by NA-3, 1,713 miles; by NA-2, 1,073 miles.

"Total miles flown away from Etah by three planes on work accomplished for flight mission, 5,286 miles.

"Only one forced landing occurred on these flights. The NA-3 was forced down on the way to Igloo Dahouny, a half mile from Etah harbor.

"Approximately 30,000 square miles were seen from the planes on these flights. Of course, many of the flights were made over the same course south and southeast of Bay Fiord, extending for 70 miles.

"There are mountain ranges and mountain peaks, some of which reach an altitude of at least 7,500 feet and mostly covered with snow, except for a few comparatively low ranges near Bay Fiord.

"These mountain ranges do not show on any charts which I have seen. Mountain ranges lie nearly all of the way from Sawyer Bay to Cannon Fiord, and it is thought that most of this region is unexplored by white men.

"There is a lake about two miles long frozen over in the mountains between Sawyer Bay and Cannon Fiord about 20 miles from the northwest end of Sawyer Bay.

"The Greenland ice-cap reaches an altitude of at least 10,000 feet in a direction 100 degrees from Robertson Bay.

"It is thought that little has been known heretofore of ice conditions around Ellesmere Island in the summer period. Nearly all of the many fiords seen by us show them to be filled with ice which occasion-

ally opens up, but soon closes in again. Bay Fiord and Eureka Sound east of Axel Heiberg Island are filled with drifting ice. The land in Ellesmere Island is firm, but too rugged to afford a landing place.

"In all territory flown over the Greenland ice-cap a comparatively warm stratum of air was experienced at 7,000 feet, and a bitterly cold one at 11,000 feet."

While the Navy flyers and MacMillan were making airplane history in the Arctic, other members of the expedition were engaged in transcribing in a series of remarkable color photographs the tints and hues of the Frozen North—north Greenland's surprising flower vales, the bizarre costumes of Eskimos, the animal, bird, and plant life that only the eyes of occasional explorers have ever beheld.

Dr. Walter N. Koelz, chief naturalist of the expedition, has collected data on fish life of the north and has studied and photographed winged snails, found floating through the waters of Etah harbor. He has also obtained the juvenile plumage of many birds that, while resident of the southern and central portions of North America during the winter months, breed within the Arctic Circle and are consequently little known. Specimens of bird species poorly represented in most of the museums of the United States, such as the Greenland Redpoll and the Purple Sandpiper, have also been collected.

Commander MacMillan, an authority on early Norse history, has pursued his studies of the Norse ruins in Greenland.

DAILY NEWS REPORTS GIVEN OUT BY
THE SOCIETY

A unique feature of the MacMillan Arctic Expedition was the daily contact maintained with civilization by means of the short wave length or high frequency radio transmission, and an important aspect of the work was the coöperation throughout the United States of some 1,200 amateur radio operators of the American Radio Relay League.

From the Atlantic to the Pacific, and from the Gulf of Mexico to Canada, these radio amateurs, who accept no pay for their services, have worked long hours in the night receiving messages of many thousands of words, addressed to the National Geographic Society and the



Photograph by Maynard Owen Williams

ON BOARD THE FLAGSHIP "BOWDOIN"

Commander Donald B. MacMillan, leader of the MacMillan Arctic Expedition; Dr. Gilbert Grosvenor, President of the National Geographic Society, and Dr. Wilfred T. Grenfell, medical missionary. The photograph was taken at Battle Harbor, Labrador.

Navy Department, and given by them to the newspapers and press associations. Thus the news of the expedition forwarded by Commander MacMillan, Lieutenant Commander Byrd, and by The Society's representatives was published daily.

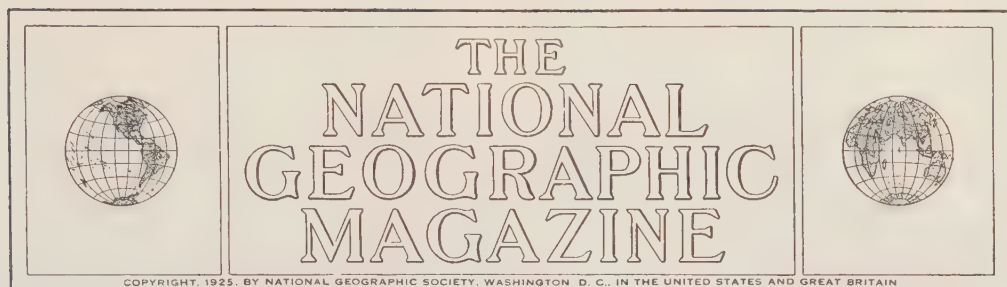
The wave lengths used by the Zenith equipment ranged from 16 to 40 meters. These are especially advantageous, because they can be employed in the daytime and the expedition was working in 24 hours of daylight, and also because extremely high power is not required for their sending.

So successful was the radio communication that the expedition was not out of touch with the National Geographic Society or the Navy Department for a single day during the entire summer. Messages were picked up all over the United States

and also in England, Australia, New Zealand, and Canada.

Not until the complete report of Commander MacMillan is given to The Society for publication in the NATIONAL GEOGRAPHIC MAGAZINE, along with the pictures from the air and color photographs which give new impressions of the Far North, will the full results of the expedition be known and contributed to the world's knowledge. Preliminary reports, however, from the various members of the party show tangible results in the fields of topography, meteorology, zoölogy, ornithology, botany, and ichthyology which fully justified the labor, the hardships, and the sacrifices entailed.

Above all, the members of the National Geographic Society rejoice in the safe return of every member of the expedition.



THE MACMILLAN ARCTIC EXPEDITION RETURNS

U. S. Navy Planes Make First Series of Overland Flights
in the Arctic and National Geographic Society
Staff Obtains Valuable Data and Specimens for Scientific Study

BY DONALD B. MACMILLAN

LEADER OF THE MACMILLAN ARCTIC EXPEDITION, UNDER THE AUSPICES OF THE NATIONAL GEOGRAPHIC SOCIETY,
IN COÖPERATION WITH THE UNITED STATES NAVY; AUTHOR OF "PEARY AS A LEADER" AND "THE
'BOWDOIN' IN NORTH GREENLAND," IN THE NATIONAL GEOGRAPHIC MAGAZINE

IT is natural for man to wonder what lies beyond the mountain peaks, what strange and interesting things may be below the encircling horizon. Without this incentive there can be but little progress.

True, dreams of untold wealth, of Eldorados, of waters potent with eternal life, of lotus lands free from care, of a life of happiness, have all driven men on into the unknown; but man's inborn desire to seek, to know, has been the dominant factor in the exploration of the world, no section of which has proved more attractive than the North, with its far-stretching, grinding ice fields, its eternal, snowcapped peaks, its encircling sun and stars, its strange forms of animal life, and its swarthy, square-faced aborigines.

Man's ingenuity has devised many a scheme for the exploration of this great unknown area. Staunch ships have been built and crushed. Man has harnessed himself to his sledge and plodded slowly, painfully on. Sails and even gigantic

kites have been utilized in this arduous toil. Siberian ponies, burros, reindeer, dogs, balloons, and motor sledges have all played their part—some successfully. Thus far the dog remains king.

With the marvelous development of airplanes and their noteworthy feat of encircling the world, naturally such means would be considered for conquering the North, especially during the summer months, when the temperature, being well above the freezing point of fresh water, is one of the least factors to be considered in the proper functioning of the gas engine. Given proper *landing places* and *time*, nothing can militate against eventual success, provided engines are fairly reliable.

THE GREAT MYSTERY OF THE POLAR SEA

One great area in the Polar Sea remains a mystery—roughly, that between Alaska and the Pole and northwest of Axel Heiberg Island. Here at least twice land has been reported and here tidal experts have predicted that it would be



Photograph by Jacob Gayer

BATTLE ISLAND AND BATTLE HARBOR FROM THE HEIGHTS OF GREAT CARIBOU,
LABRADOR

The *Bowdoin* lies at the dock, taking on fuel oil for its long run to Etah and return. The white buildings are connected with the fishing industry and general trading. Jutting out behind the general store, in the center, is one of the hospitals of Dr. Grenfell. Against the skyline can be seen the aerial of the northernmost year-round radio station on the east coast of America. Inland from the *Bowdoin* can be seen a corner of the extensive fish-drying platforms. Battle Island is the legendary scene of early fighting between Eskimos and Indians and is the concert platform for the loudest "husky" dog chorus in the world.

found. The quest for this land was the primary object of the so-called Crocker Land Expedition of 1913-17. Inaccessible by ship and extremely difficult to reach with dogs, it awaits exploration by air.

The rough ice of the Polar Sea, thrown into hummocks and pressure ridges by strong winds and currents, precludes the possibility of safe emergency landings. Such exist, however, and can be found in the early spring months, before the warm summer sun thaws the covering of wind-packed snow and reveals a hard, blue, rolling surface interspersed with pools of water of varying depths.

Since no one has ever visited this section during the summer months, no data are available for determining the relative amount of open water. From my own experience and that of Peary and Nansen, it is reasonable to infer that the "leads"

increase in size and number as the season advances. Therefore one's chief dependence should be upon a water plane. However, conditions demanded that a plane might be called upon to take off from and alight upon land, ice, or water. The Loening Amphibian has these requisite qualifications; hence our choice of this particular type.

Etah, North Greenland, eleven and a half degrees from the Pole, is the ultimate port in Smith Sound which a ship can safely visit and leave the same season; therefore my choice of this well-known place as headquarters.

THE ORGANIZATION OF THE 1925
EXPEDITION

The National Geographic Society, ever progressive, ever interested in Arctic study, and ever ready to sponsor plans having as their object the exploration of



Photograph by Jacob Gayer

THE "BOWDOIN" ATTEMPTS TO PULL THE "PEARY" OFF THE ROCKS WHEN THE LATTER GOES AGROUND NEAR HOPEDALE, LABRADOR

Later, the *Peary* repaid the debt by bucking a way through the dread Melville Bay ice-pack on the way north and by coming to the aid of the *Bowdoin* when she went on the rocks off Redcliffe Peninsula on the return trip (see text, page 513, and illustration, page 504).

the unknown and the diffusion of geographic knowledge, financed my expedition of 1925 from funds provided by its million members, and encouraged me in every possible way to bring back worthy results.

Four men were detailed as assistants: Lieutenant Benjamin H. Rigg, of the U. S. Coast and Geodetic Survey, as magnetic and tidal observer; Dr. Walter N. Koelz, of the U. S. Bureau of Fisheries and the University of Michigan, as naturalist; and Mr. Maynard Owen Williams and Mr. Jacob Gayer as staff correspondent and color photographer, re-

spectively, of the National Geographic Society.

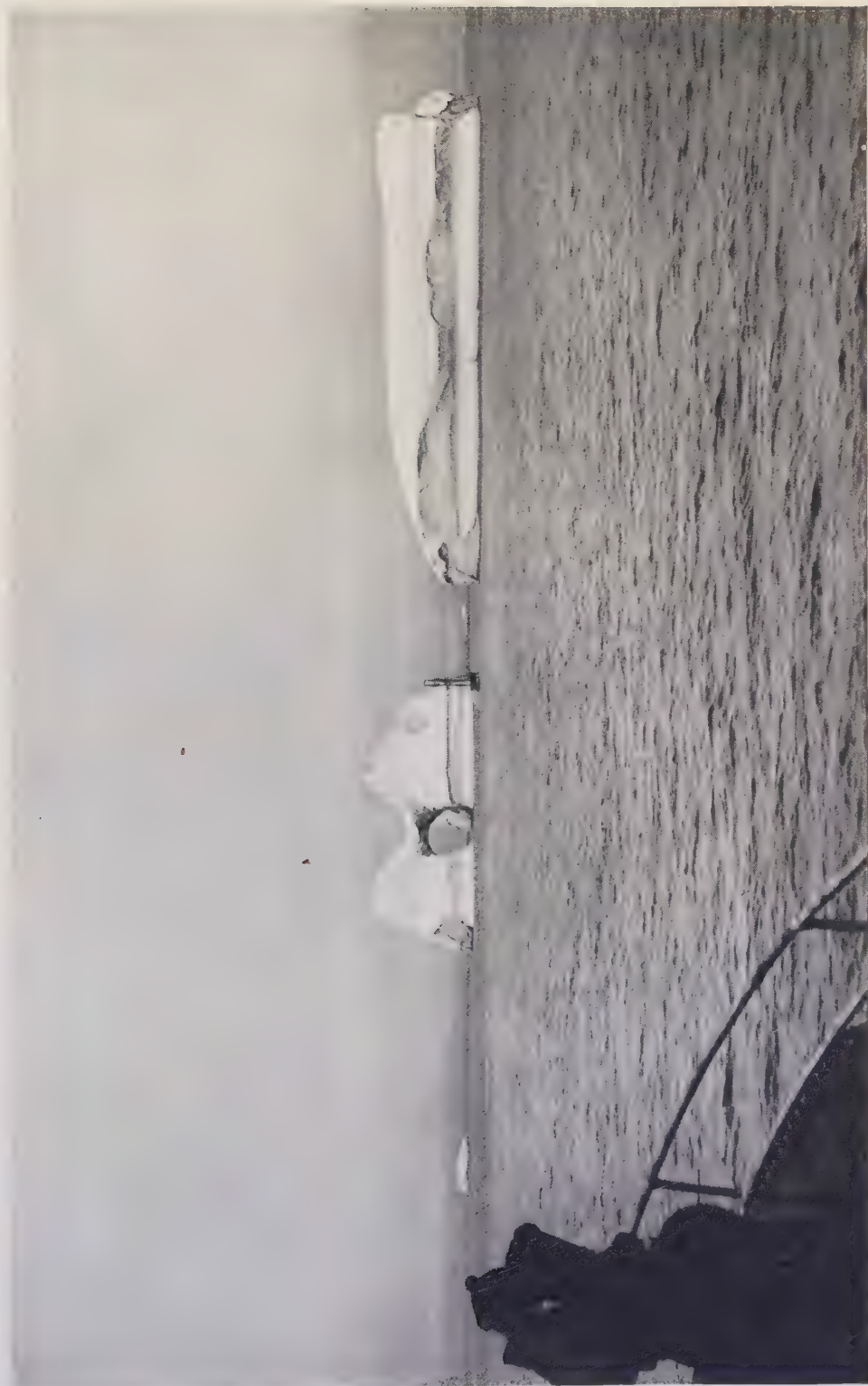
The United States Navy generously cooperated with The Society in the furtherance of my plans by sending a separate unit of eight men and three amphibian planes for the work on the Polar Sea. These men and this branch of the work were under the command of Lieutenant Commander Richard E. Byrd, Jr., of the Bureau of Aeronautics. Since I was merely a passenger on the planes, traveling with his permission, credit should be given to him for what the planes really did. (See pages 519 to 532, inclusive.)



Photograph by Jacob Gayer

THE "PEARY" IN HARBOR BEHIND BATTLE ISLAND, LABRADOR

Along the Labrador coast the many islands offshore provide good "inside runs" and adequate harbors. When the straits are so narrow that navigating them is "ticklish work," they are called tickles, and on the trip "down north" both the *Bozdown* and the *Peary* threaded dangerous passages rather than put out into gales which might sweep the planes from the deck of the latter, which carried the Navy personnel.



Photograph by Jacob Gayer

MIDNIGHT SAILING INTO THE HOME OF THE ICEBERGS

This splendid arched berg was encountered just at midnight on July 30-31. The *Boradoin's* 60-foot masts are quite dwarfed beside the ice mass, seven-eighths of which is below the water. Within a few hours after this photograph was made the fog was so dense that one could scarcely see the length of the ship, and further cruising among the bergs of upper Baffin Bay was suspended until morning brought a clearer sky.



Photograph by Jacob Gayer

SAM BROMFIELD BROADCASTS ENTERTAINMENT FROM THE LABRADOR WILD

British subject, proud of his king; father of Abram, proud of his son; lover of merriment, proud of his skill, the "Mayor of Jack Lane Bay" plays his fiddle for an invisible audience half a continent away.

In contrast to the lone, silent months that Peary, Greely, and other explorers spent in the Arctic with no word from home, was our experience of hearing the voices of our friends, and concerts from our home cities, by radio.

For the transmission of our day-to-day messages, through the National Geographic Society and the Navy Department, we also depended upon our radio and the fine, unselfish, and unflagging coöperation of the code radio operators who are members of the American Radio Relay League.

Press associations and newspapers coöperated in this news transmission which, in itself, was of value to the science of radio, and which demanded constant resourcefulness at the receiving end, because we never could be sure that we would send by the same operator on two successive nights. It was the amateurs who relayed the messages to be distributed at Washington and made it possible for members of the National Geographic Society and all readers of

newspapers to follow our day-by-day movements.

E. F. McDonald, Jr., was in general charge of radio; equipment furnished by the Zenith laboratories was used, and my own operator aboard the *Bowdoin* was John L. Reinartz, known to amateurs the world over, while the *Peary's* dispatches were ably handled by Paul J. McGee and Harold E. Gray.

TWO SHIPS OF THE EXPEDITION SAILED NORTHWARD ON JUNE 20

The steamship *Peary*, with my second in command, E. F. McDonald, Jr., carrying the Naval unit and the three planes, was given a rousing send-off from the Charlestown Navy Yard on Bunker Hill Day and joined the *Bowdoin* at Wiscasset, Maine, from which port both ships sailed on June 20 for Sydney, Cape Breton Island, Nova Scotia, to take on the last supplies of coal and fuel oil.

A few necessary changes on the *Peary* were effected at Sydney. Portholes were covered with steel plates, the better to resist ice pressure in dread Melville Bay.



Photograph by Jacob Gayer

GREENLAND GIRLS OF UMANAK

The south Greenland population contains little Eskimo blood, and the people are called Greenlanders irrespective of the proportions of their racial make-up. The costume is distinguished for its bright bead collar and fine boots, but the most colorful bit is the thigh panel on the tight sealskin trousers. Inside a border of shiny red there is a strip of white from a reindeer breast, and the inner section is a polychrome mosaic composed of hundreds of tiny bits of leather sewn to the background. The old style of combing the hair has given way to ugly knitted caps.



Photograph by Jacob Gayer

A JULY DAY AT UMANAK, WHERE THE "PEARY" COALED

The glacier at the head of Umanak Fiord sometimes advances 50 feet a day, and casts off so many bergs that the water is never free of ice. The coal mines are about 14 miles away from this unusually prosperous little settlement on the north edge of the Nugsuak Peninsula, north of Disko Island and Disko Bay, where Peary began his Arctic work.



Photograph by Maynard Owen Williams

PANDORA HARBOR AND CAPE KENRICK FROM CRYSTAL PALACE CLIFFS

This quiet harbor, just north of Cape Alexander, was the anchoring place of Sir Allen Young's ship *Pandora* in 1876. Off its mouth herds of walrus are frequently seen and the hills are full of snow-white Arctic hares. In the distance are the snow hills of Ellesmere Island. Etah is about eight miles away to the north, off the right side of the picture. In the right foreground is the *Bowdoin*.



Photograph by Maynard Owen Williams

WHEN FOG AND PACK ICE HALTED THE SHIPS ON THEIR NORTHWARD PUSH
THROUGH MELVILLE BAY

Three days from Etah the *Bowdoin* and the *Peary* encountered fog, which made ice pilotage impossible. The situation looked gloomy. Commander MacMillan decided that a diversion was necessary, so a snowball fight was staged by both crews, after which Chief Aërographer Francis dived into the waters of Melville Bay.

The delay caused by this work and the refilling of the bunkers resulted in the *Bowdoin* proceeding to Battle Harbor, Labrador, a few days in advance. Here the *Peary* rejoined us on July 2, both ships going north on the 5th to Domino Run, where we purchased a supply of native sealskin boots, much lighter and warmer for northern work than our homemade product.

Five miles east of Cape Harrison both ships met the ice-pack lying close against the land and extending north in an almost unbroken sheet.

This was the *Peary's* first encounter with the pack. It is generally conceded by experienced men that an iron ship is not the equal of a wooden ship for northern work. When bucking ice, rivets are easily started; when sailing in uncharted waters, grounding is imminent at any moment; and steel hulls are easily punctured by sharp rocks. There are no dry docks in the North except the beach,

which a deep-draft ship cannot reach. A steel hull cannot be compressed without serious injury. A wooden hull will spring back into shape.

The *Peary*, with her 600-horsepower triple expansion engines, her 9-foot propeller, and her triple-plated bow, nosed her way through the ice as if this were mere play. I was relieved of all anxiety about her ice-bucking ability.

Before us lay possibly the most difficult bit of navigation of the whole trip—the inside run from Cape Mikkovik to the Moravian settlement at Hopedale. The most able captain could never navigate this by chart. On the Labrador coast, north of Hamilton Inlet, experience is the only guide.

With one eye over our bow and the other back over my shoulder at the flaring bow of the *Peary*, close behind. I directed the *Bowdoin* over the path she knew so well.

When approaching Flagstaff Tickle,



Photograph by Jacob Gayer

THE LEADER OF THE EXPEDITION WELCOMED BY SMITH SOUND ESKIMOS

Just south of Conical Rock the *Bowdoin* was greeted with the sound of guns, and two Eskimos dashed out from the shore in their kayaks to welcome the members of the Expedition. They are here seen receiving gifts of tobacco, one of the few things for which the Eskimo must depend upon the outside world (see text, page 500).

nine miles from Hopedale, the course lies near a breaking ledge so close on the starboard that Captain Steele of the *Peary* was a bit overcautious. I was on the point of waving him in, when up shot the bow of the *Peary* and over she went on her side. We whirled the *Bowdoin* hard-a-starboard and within a few minutes were alongside the *Peary* (see page 479).

Always when a ship grounds the all-important question is: "Is the tide running or falling?" To our relief, it was rising, and it was only a matter of time until the *Peary* would be afloat. But, since pounding upon the rocks would certainly result in injury to the hull, it be-

hooved us to do everything possible to get her off at once.

Captain Steele, with his practical knowledge of the sea, suggested that the *Bowdoin* pull the *Peary* off by the masthead, a well-known method of decreasing the draft of a ship. Our attempt to do this resulted in pulling the *Peary* over from her list to port to a heavy list to starboard and in snapping our hawser. We then ran out kedge anchors from stern and bow and picked up Captain Steele and three of his crew in a small boat, who were vainly endeavoring in a rough sea to run out another hawser.

In the meantime some of the men on



Photograph by Maynard Owen Williams

ROLLING A WALRUS ONTO A ROCK BEACH AT LOW TIDE

In winter the Eskimos are skillful in hauling their walrus trophies onto the ice, but in summer they capture specimens too heavy to drag ashore. They bring their catch as near to land as possible, and then make the receding waters provide them with a dry dock.



Photograph by Jacob Gayer

WHERE AN ADVANCING GLACIER BECOMES A SHRINKING LAKE

Within the memory of living men John's Glacier, which terminates Foulke Fiord, ended at least half a mile back of Alida Lake. To-day it drops away into the lake itself.



Photograph by Jacob Gayer

THE EXPEDITION NATURALIST SKINS BIRDS ON THE DECK OF THE "PEARY"

Lacking adequate storage space for his specimens, Dr. Koelz spread out his drying skins on his bunk, while he slept on deck. Each specimen had to be properly ticketed and no egg was taken unless the mother bird could be secured.



Photograph by Maynard Owen Williams

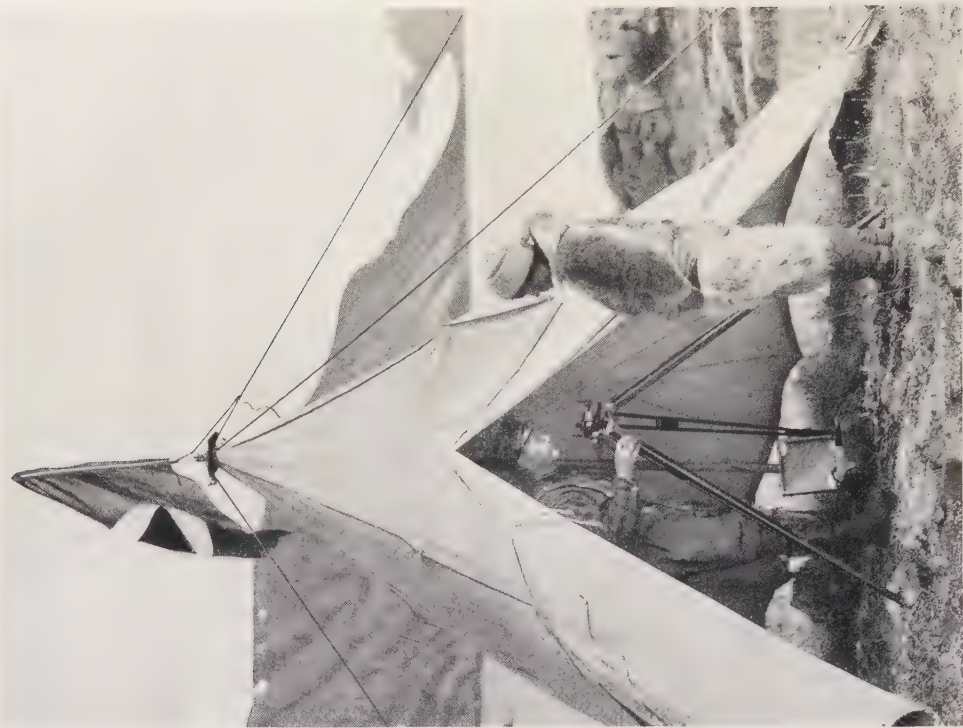
POSING FOR THE NAVY'S AÉROGRAPHER AND MOTION-PICTURE PHOTOGRAPHER

This future hunter among the Smith Sound Eskimos shows how acceptable a ten-cent mouth organ can be to a regular boy who had never seen or heard one.



THE MACHINE WITH WHICH THE TIDES AT ETAH SIGNED THEIR FIRST AUTOGRAPH

Lieutenant Benjamin H. Rigg carried with him to Etah an automatic tide gauge which recorded every move of the sea. Because of an unusual tidal range, the piping taken to the Arctic was not long enough and an extension had to be made of boards from airplane crates.



Photographs by Jacob Gayer

AK-KOM-A-DING-WA WATCHES LIEUTENANT RIGG AT HIS SCIENTIFIC WORK IN ETAH

Over the tent flies the flag of the United States Coast and Geodetic Survey, under which Rigg has worked on our South Atlantic coast, off Alaska, and in the Sulu Sea. The magnetic force at Etah is only one-tenth as strong as at New York, so compass readings require great care.



NOO-KA-PING-WA AND HIS HARPOON TROPHY

In capturing this walrus head there was plenty of excitement for all. At least a hundred walrus were in the herd which gave battle to the Expedition hunters. One kayak was overturned, two bladder floats were punctured by enraged walrus bulls, and the herd was kept at bay by rapid fire from high-power rifles. Three walrus were dragged in for meat and museum specimens.



Photographs by Maynard Owen Williams

REINARTZ, AT ETAH, LISTENS IN ON THE WORLD

Much of the success of the Expedition's radio work depended upon the eager cooperation of Reinartz's associates of the American Radio Relay League in transmitting messages. More than 30,000 words of news dispatches alone were sent out from the *Bowdoin* addressed to the National Geographic Society and released by it, day and night, to the press associations (see text, page 482).



ESKIMO WOMEN ON THE "PEARY" LISTEN IN



Photographs by Jacob Gayer

PRIMITIVE MAN ESTABLISHES CONTACT WITH HIS FELLOWS ABROAD

In-you-gee-to, one of Peary's men, sings an Eskimo song for the nation for whose representatives he considers no feat impossible. Commander MacMillan introduced the phonograph, the telephone, the movie, and many other modern inventions to his Eskimo friends; but as for wireless, why should it not be more simple to talk without wires than go to all the trouble of stringing them? The photograph shows the dining saloon of the *Peary*.

the *Peary* were packing bags preparatory to leaving the ship. Many interesting and amusing incidents happened during the excitement.

Captain Steele, starting his steam winch, soon had his hawser tight as a fiddle string. With the rising water, the *Peary* swung from the rock and rode to her kedge, a few yards from the breaking reef.

Instructing Captain Steele to keep directly behind us, we threaded Flagstaff Tickle, passing two bad underwater rocks, where many a Newfoundland fishing schooner has been wrecked.

Upon reaching Hopedale we found the Mission flag snapping in the breeze to give us welcome.

It would take many issues of the NATIONAL GEOGRAPHIC MAGAZINE to give its readers an adequate idea of what these brave and unselfish Moravian missionaries have been doing on the bleak Labrador coast for the last

154 years! Were it not for the Moravians, there would not be a single living Eskimo on that coast to-day. From the time that Jensen, standing with outstretched hands in the bow of a boat, called, "I am your friend!" life has been safe for Eskimos there.

Eskimo history is the history of all savages, slowly retreating from the outposts of civilization and dying from its diseases. Once a great race, extending to the northern shores of the Gulf of St. Lawrence, they are not to be found to-



Photograph by E. E. Reber

AK-KOM-A-DING-WA, CONFRONTED WITH AN ELECTRIC FAN IN THE ARCTIC, SEES THE JOKE

But he did not appreciate the use of this unusual bit of Arctic equipment. The National Geographic Society photographers, in their effort to record the delicate tints of the North, were forced to dry their plates quickly to avoid spottiness (see text, page 515).

day until one reaches the half-breed at Mokokvik, 55° 14' N.

The strenuous fight of the Moravians has been waged not so much against the ignorance, superstition, evil practices, and primitive religion of the savage as against the sins of the so-called civilized.

ESKIMO WOMEN OUTFIT EXPEDITION WITH SEALSKIN COATS

The crews of both our ships fairly mobbed the Mission store in their eagerness to secure the light, water-tight seal-



Photograph by Maynard Owen Williams

THE ESKIMO WOMAN'S CHIEF TASK: REPAIRING FOOTWEAR

In a region where death from exposure is a constant threat during much of the year, the work of woman has evolved into that of seamstress. Koo-e-tig-e-to's wife here shows how a skin stocking is made. Since the jaw gives the firmest possible grip, it is much used in shaping the Eskimo footwear.



Photograph by Maynard Owen Williams

ME-TIK, WHOSE NAME MEANS EIDER DUCK, SHOWS HOW TO EAT RAW MEAT

The flesh of birds is much esteemed by the Smith Sound Eskimo, who has few worries over a balanced diet and who never suffers from scurvy. Rheumatism, ascribed by some to the all-meat diet, is common.

skin native boot. Two days of busy sewing by the native women fitted out many of the crew with blanket "dickies" and sealskin coats.

On July 10 we were away at 1:30 a. m., threading our way through the narrow Dark Tickle, on past hidden rocks to Windy Tickle, where we anchored to give me an opportunity to run up in the powerboat for my old interpreter, Abram Bromfield, who had accompanied me on two previous trips.

On our return to the *Bowdoin*, preparations were made for the immediate departure of both ships for Greenland. When the anchor was on the bow, I rang the telegraph "Full speed ahead!"

With amazement I noted the engine turning rapidly, but not an inch of headway. For the first time in my service, the *Bowdoin* refused to move. Had we broken our shaft? Had we lost our propeller? I peered into the water under

our counter and saw the propeller still in place, but absolutely dead.

After calling to the *Peary* to go on, and promising to rejoin her in Greenland, a more thorough examination was made.

A NEW PROPELLER FITTED TO THE
"BOWDOIN"

The *Bowdoin*, with her 10-foot draft, was designed to equal the rise and fall of Arctic tides with a view to beaching her, when necessary, for repairs, but our accident happened at one place in Labrador where there is a rise of only four feet at neap and seven maximum at spring tides. We needed at least eight.

We were in a serious predicament. The *Peary* could not do the summer's work alone. She had gone on with the planes and aviators, but the *Bowdoin* carried spare parts, three Liberty engines, and 1,500 gallons of gas. There was only one thing to do—return to Hopedale,



COMMANDER MACMILLAN WITH ONE OF HIS YOUNG ESKIMO FRIENDS AT ETAH



Photographs by Maynard Owen Williams

IN-YOU-GEE-TO READY TO FEED THE RAVENOUS DOGS OF ONE OF HIS SLEDGE TEAMS

Those whose dependence has been on the Eskimo dog have infinite faith in its powers and usefulness. Engine or fuel, as the conditions require, the husky begins life as the playmate of the children and often ends it in saving the life of his master. Always hungry, often savage, the Eskimo dog still has qualities which endear him to all his friends.

where there were higher tides and plenty of Eskimo help and equipment. Our trip back, towed by the Bromfield motorboat, was a painfully slow 25 miles.

Now began a tedious delay for a greater tidal range and a struggle to lift the stern of the *Bowdoin* sufficiently high to substitute our spare propeller. This was finally accomplished in five days by shifting all heavy weights to the bow and placing eight empty casks under the stern. Even then the men were compelled to work in ice-cold water and amid swarms of ravenous mosquitoes!

With interest we examined our old propeller, now upon deck. The cause of the injury was apparent. When endeavoring to salvage the Peary lifeboat at the time of her grounding, we had wound a rope so tightly around our main shaft just abaft of the stuffing box that the patent gears of our self-feathering propeller had actually burst the hub.

We were away on the 19th at full speed to rejoin the *Peary*, anxiously awaiting us at Godhavn, Disko Island. Early on the morning of the 24th, after a fine run up the spectacular Greenland coast, we shot around our sister ship and dropped anchor in front of the Governor's house. We were together again.

The *Peary* is a coal burner, and before



Photograph by Maynard Owen Williams

IMPROMPTU ESKIMO ART ON ONE OF GREENLAND'S RARE SAND BEACHES: IGLOODAHOUNY

At Etah new ice had formed on the harbor. At this spot on Robertson Bay, only 50 miles farther south, there were footprints of bare feet, showing where the Eskimo children had been at play. It is hard to distinguish between the Eskimo men and women, since the costume is much the same, but the hourglass or lamp-chimney hair dressing of the figure (head down) on the left shows that it represents a woman. The *Bowdoin* is anchored in waters made smooth by the iceberg barrier reefs at the mouth of Robertson Bay. In the distance is Herbert Island, near whose shores in 1909 Peary, the Pole conqueror, helped his Eskimos hunt winter food before he dashed homeward with the glad news of his discovery.

leaving home I had made arrangements for fuel at some Greenland port, but the Danish officials declared that no coal could be spared at Godhavn. Through wireless communication with Washington, however, the good offices of the Danish Minister, Hon. Constantin Brun, were enlisted and by the time the *Bowdoin*



Photograph by Maynard Owen Williams

WHAT A GEOGRAPHIC PHOTOGRAPHER FOUND IN OO-BLOO-YAH'S TUPIK

Nothing pleased the Eskimos more than the pictures of their people as printed in the NATIONAL GEOGRAPHIC MAGAZINE for June, 1925 (see, also, illustration, page 510), and a copy of this number is here seen amid the clutter of presents and household utensils. Teapot, comb, matches, wooden beads, A B C book, and knitted cap—it is evident that the explorer, bringing gifts, has modified the life of the primitive folk of Igloodahouny.

arrived coal had been promised at Umanak, as much as we could possibly load on the ship. Governor Rosendahl, of Godhavn, volunteered to accompany the *Peary* to the coal depot, 180 miles north, personally to superintend the loading of the coal.

A SEAL HUNT ON THE PACK ICE

As both ships proceeded northward we encountered our first ice off South Upernivik, a scattered field, through which we easily passed. A half hour later we met the real pack—hard blue ice five feet thick. We were glad to follow the *Peary*, slowly smashing through it with her reinforced steel-concrete bow.

Finally conditions were such that we tied up to a large sheet to await better luck. When I awoke from an hour's sleep, I found the field dotted with hunters and photographers.

Within a few minutes Rawson came running over the ice, shouting that Bromfield had killed a seal and wanted his har-

poon. The seal, our first fresh meat, was quickly secured and brought on board.

With a change of tide the leads began to open up. We blew the *Peary's* steam whistle to recall our men, all of whom responded except Salmon, who was caught on the far side of a wide crack, which he crossed subsequently with difficulty.

We fought the pack all day, the *Bowdoin* generally following the more powerful *Peary*, which split big pans wide open. When dealing with the solid, unbroken pack ice, the *Bowdoin* was far inferior to her big sister, but in loosely packed ice, in narrow leads with sharp turns, the *Bowdoin* left the *Peary* almost hull down.

At 6 o'clock we were free of the ice and stopped our engines for 45 minutes to await the *Peary*. At 11:30 we were again in the midst of it, slowly working westward toward Cape York.

On July 29 little progress was made. We did not know which way to turn, since a thick fog prevented intelligent ice

pilotage. Fresh bear tracks kept the boys interested and a bit excited over the prospect of fine rugs for their dens.

The 30th was a hard day for both ships. The *Bowdoin* was so tightly wedged that the *Peary* was called upon to extricate her from the jaws of huge ice pans.

As it happened, I spent the day conning the *Peary* through the ice, and therefore had a good opportunity to witness the *Bowdoin* in action—a wonderful sight. Like a thing alive, she twisted and turned through the leads, and when meeting a floe which she could not avoid, fairly leaped out of the water, her clean-cut bow shooting up to such an angle that it seemed as if she were coming out bodily on top of the ice.



Photograph by Maynard Owen Williams

CAUGHT IN THE PACK

Finally the *Peary*, strong as she is, was absolutely helpless. Four times she had hurled herself at full speed into a crack between two tremendous pans, hoping so to shatter the edges that she might squeeze through. The *Bowdoin* circled about in a narrow basin, jockeying for a dash at the rift made by the bigger ship the instant the latter cleared the narrow opening. The last time, the *Peary* became so tightly wedged that her 9-foot, 4-bladed propeller failed to back her out. We stopped engines, put out ice anchors, and awaited a change of wind and tide. Our best was not enough.

THE EXPEDITION NATURALIST SUGGESTS LOOSER STYLES IN TROUSERS

The wife of Oo-bloo-yah marvels at the size of American men and wonders how she can alter a pair of bearskin trousers to fit one of the Expedition's slenderest members. Both the Eskimo and his wife are thin-hipped, and their trousers are altogether too small for adult Americans. Her tailoring duties do not interrupt this woman's afternoon smoke.

The Arctic is full of surprises, the biggest of which is the sudden change in ice conditions. To the novice our case appeared hopeless and our date of arrival at Etah seemed a long way off. At 4 p. m. we were held tight. At 10 the *Peary* started through the lead without the help of the engine!

So rapidly was she moving that we ran a towline to the *Bowdoin*, snuggling under the red, white, and blue tails of the planes, as if afraid of being left behind.



Photograph by Maynard Owen Williams

AN ESKIMO YOUNGSTER SHOWS EVIDENCE
THAT THE SEA HAS ITS UNICORNS

The chief game of the men of Igloodahouny is the narwhal, or sea unicorn, and beside each tupik were found several spiraled tusks which the Expedition members eagerly sought as souvenirs. It is not unusual to find narwhal tusks 10 feet in length and thicker at the base than baseball bats.

At five the next morning we were again underway, breaking out through the pack into open water and heading straight to Cape York, the hard-fought goal at the end of the Melville Bay ice field.

There most of our men saw their first polar bear not in captivity. She ambled along over the ice fields, just out of rifle range, on a course parallel to that of the *Peary*. To our surprise, she turned toward us, and plunged into open water almost under the bows of the ship. A fine shot by McDonald gave us a specimen for the Provincetown Museum.

Cape York was blocked with ice and clearly inaccessible. We reluctantly passed it by, for here we always receive the first news of the Smith Sound Eskimos.

A broken field extended northward in under the Crimson Cliffs. While we were working through it, two rifle shots were heard and two kayaks were seen paddling toward us from three tents on the beach. The visitors were Tung-we, an old-time assistant of Peary's, and young Mamona.

"Tobacco!" was the cry, as it always is during the summer months, when these natives are cut off from the trading station, Thule, at North Star Bay. We stopped our engines, supplied their wants, and hastened on (see page 487).

Shortly after passing Conical Rock we encountered a fog so dense that we narrowly missed several large bergs looming mountainlike in the mist. The *Peary*, being longer, does not respond as quickly to her helm as the *Bowdoin*. She was therefore in greater danger of collision. A radio request from Captain Steele that we lay to for a while was readily complied with, since the compasses on both ships were extremely sluggish and at times varied by 20 and 30 degrees.

THE EXPEDITION REACHES ITS BASE AT
ETAH

The fog soon lifted, and we hastened on to Etah, where we arrived in a snow-storm, three hours ahead of schedule, on August 1.

My plans were for the arrival on this date and for the departure about August 25, but not later than September 1. Since the crews of our ships numbered 39 men and we were only provisioned for three



Photograph by Maynard Owen Williams

MOTHER AND INFANT IN THE CLOTHING WHICH COMBATS ARCTIC COLD

The first essential of Eskimo dress is that it must be practical, for storms are frequent and the nomad life precludes a large wardrobe. The seal skin blouse, with the hood in which the baby is carried, serves to keep out the rain and snow. An underblouse of eider-duck breast-skins furnishes warmth. The short trousers are of fox skin and the long, frost-bleached seal skin boots are waterproof. Woman's chief duty in the North is to provide the clothing which will protect her family from the cold (see, also, illustration, page 494).



Photograph by Maynard Owen Williams

SIP-SOO'S DAUGHTER IN FRONT OF HER SUMMER HOME AT
IGLOODAHOUNY

On a grassy slope, whence one can look across an arm of Robertson Bay to Herbert and Northumberland Islands, one of Peary's men has set up his tupik, the sealskin tent which serves the Eskimo for a summer home. Here Sip-soo's youngest daughter is seen with a draft animal of the future, already a pet.

months, an enforced wintering in the North, by one or both, would be a serious matter.

Our work of landing and assembling planes, of establishing food and fuel stations on Ellesmere Island, and of flying at least 2,000 miles must all be done within this allotted time. Every minute must show something accomplished.

My men on the *Bowdoin* at once began work on the landing beach, removing all stones and boulders and smoothing it up until it was acceptable to Commander

Byrd and his men. The sides of the wing boxes were utilized as runways by weighting them with rocks (see page 522).

PLANES READY TO FLY
IN THREE DAYS

On August 3 the *NA-2* was ready for flight — remarkably quick work by the mechanics, a picked body of skillful men. The *NA-3* and *NA-1* followed quickly, in spite of unfavorable weather conditions. On the 4th all planes were in the air, and at nightfall, piloted by Lieutenant M. A. Schur in *NA-2*, we made the first flight over Greenland. But the engines were not running satisfactorily. Minor troubles developed in all of them.

On the 6th two planes were loaded to the limit with gas and supplies, with the intention of establishing a substation across Smith Sound. They failed to get off the water. Rain, fog, and low-lying clouds did their worst. It was decided to put a

new engine in the *NA-1*. Indeed, within 10 days all three had new engines and all had been refitted with new propellers.

Fog, rain, and wind precluded all possibility of flight on the 7th. On the 8th two Eskimos came walking over the stony hills from Anoritok, 19 miles away, to see the giant birds of the white men. They had heard the roar of the Liberty engines and had seen the black dots in the sky. With deep interest they scrutinized every detail of what they had heard so much about.

That evening we left for Cannon Fiord, on the western side of Ellesmere Island, hoping to establish a substation which might help us to Cape Thomas Hubbard, distant in an air line 250 miles.*

Smith Sound was practically covered with large sheets or pans drifting out of Kane Basin, the surface of which was of such a character that a safe landing was impossible, either with wheels or skids. Narrow lanes of open water (leads) offered possible landing places in case of emergency. But, once down, there would be no way of rising out of these leads until they had widened in lower Smith Sound.

At an altitude of 3,000 feet, we passed directly over Peary's winter quarters at Payer Harbor, and a few minutes later over the bowlder to which I had bolted, in the summer of 1924, the National Geographic Society's tablet to the memory of the Americans of the Greely Expedition who died here in the spring of 1884.

There it stands, as a silent tribute, through the darkness and storms of the great night and the long sunlit Arctic day, to the bravery and loyalty of the men who here gave their lives for the advancement of science.

Open water was visible all along the north side of the shore to the west of Cape Sabine. Buchanan Bay and Kane

* See, also, "Flying Over the Arctic," by Lieutenant Commander R. E. Byrd, Jr., in this number of the NATIONAL GEOGRAPHIC MAGAZINE.



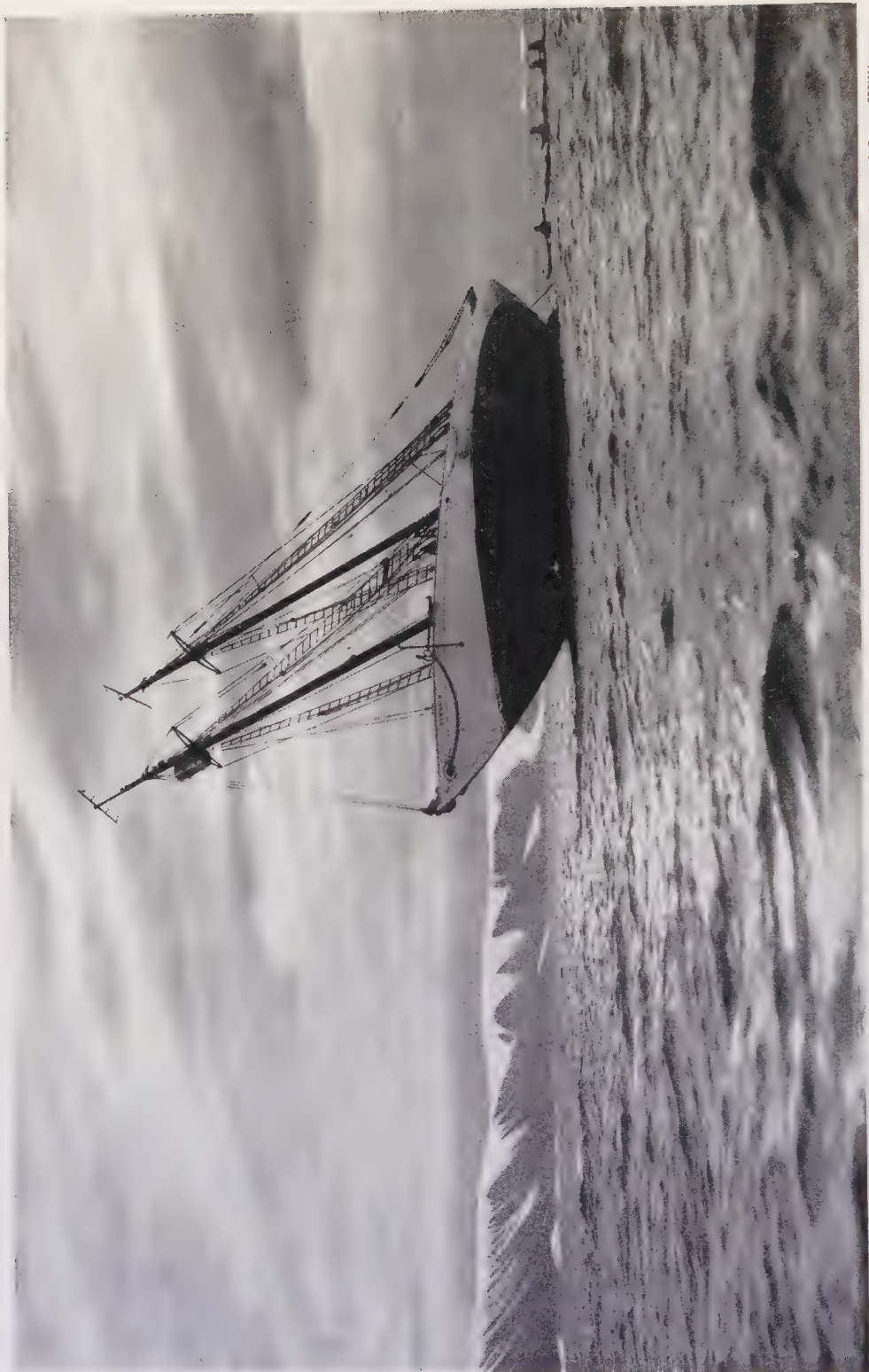
A GEOGRAPHIC PHOTOGRAPHER WITH HIS HANDS FULL

One of the little girls in her bright bead collar was afraid the camera might "go off," so the camera man submitted to the ordeal along with the rest. The gateway here seen is made of whalebone and frames a view from the home of the Governor of Holstensborg.

Basin, as far as the eye could see, were practically a solid sheet of ice, with the exception of a narrow lead alongshore on the south side of the Bache Peninsula.

FLYING OVER A TRAIL LABORIOUSLY FOLLOWED WITH DOG SLEDGES

In passing over Ellesmere Island the novice naturally would have selected the valley route, which is at a maximum height of 300 feet and has at intervals possible landing places. Schur, Reber, and Bennett, the three pilots, preferred to have beneath them the snowcapped hills, which rise to an altitude of about



Photograph by Maynard Owen Williams

THE "BOWDOIN" HIGH AND DRY A MILE OFFSHORE IN MURCHISON SOUND

While on the way to Karna to take Commander MacMillan's favorite Eskimo helper home after an airplane trip to Igloodahoumy, the flagship of the Expedition ran hard aground. A heavy deckload of gasoline drums was thrown overboard, but the sturdy little ship did not float until, near high tide, the wash from a bursting iceberg carried her off. All except six out of the 39 drums of gasoline were later rescued, in spite of a choppy sea and strong wind which carried them miles from the ship (see text, page 513).

4,000 feet, and to my surprise declared that they would rather take their chances with wheels than with skids.

A DREAM THAT CAME TRUE

A second long flight on August 11, over a more southerly route to Bay Fiord, was of intense interest to me, considering that I had traveled every foot of it by dog team in all kinds of weather. What it would be like in the summer had been a puzzling question to me.

The reader can imagine with what pleasure I looked down from a height of 5,000 feet upon big hills over which we laboriously pushed our sledges in 1914-16 and in 1924. Stripped down to undershirts and reeking with sweat, we had wallowed in snow thigh-deep, yelling at out dead-tired dogs until our throats were raw and our voices gone.

At that time I looked up into the deep-blue sky of a beautiful May day and muttered to myself, "Some day the aviator will laugh at this!" The dream had come true, as dreams generally do if one persists in them.

With absorbing interest old camping places were recognized and various experiences recalled. Here the Reid Glacier, at right angles to the course of the valley, blocked it completely, forming a gigantic dam; behind it was a lake large enough for us to have landed on its surface if necessary.

Alexandra Fiord, an inlet of Buchanan Bay, was really inviting looking, with not a particle of ice and as smooth as a mirror. The ice condition in Flagler Fiord had improved considerably since our visit a few days before, affording landing places throughout at least one-half of its length.

AN EMERGENCY DEPOT IS SIGHTED

Returning, we took a more southerly course, going east by way of the Beitstad Fiord (an arm of Hayes Fiord), which, to our surprise, was entirely free of ice. Skimming the tops of the big hills, we passed over Rice Strait (between the mainland and Pim Island, of which Cape Sabine is the northeastern extremity) to find, if possible, the hut and provision station built by the Canadian Government in 1924 with a view to the estab-

lishment of a Northwest Mounted Police station at that point.

As Schur spiraled down toward the *Fram's* winter quarters of 1898-99, we descried the square dot, which we knew to be the building, a short distance from the edge of the water.

We had learned from the Smith Sound Eskimos that they had visited the station during the spring and had found it filled with food—an emergency station for us, if need be, for we knew that our brother Canadians would not object to our using these supplies if it came to a matter of life or death.

A MOTHER WALRUS AND HER BABY DISTURBED BY AIRMEN

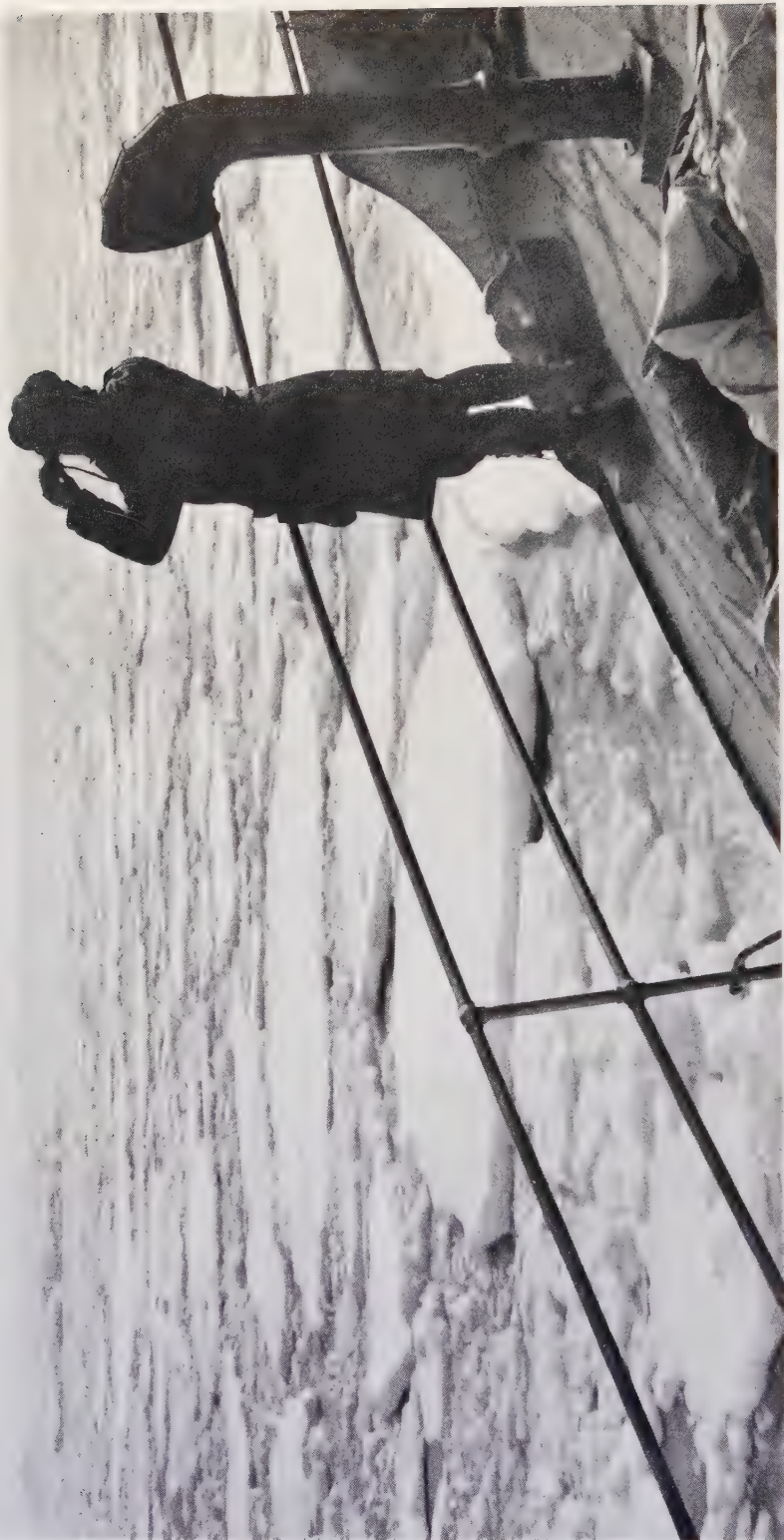
We now headed out over the ice fields of Smith Sound for home. A few miles west of Littleton Island we saw a mother walrus and her baby sleeping on a pan of ice. As we dropped to an altitude of 100 feet, the mother sleepily raised her head, roused by the roar of the Liberty.

She was plainly perplexed as to the nature of this strange and gigantic bird swooping over her. She and her ancestors had feared nothing from the air, their sole enemies being man and the polar bear. Would she brave it out? She stirred uneasily, then prodded her little one, and away they lurched beneath the water, refuting the theory that when animals encounter a new enemy for the first time they exhibit no fear.

As the waters of Beitstad Fiord had been found to be ice-free, Commander Byrd decided to attempt to land supplies at its head, as such a station might be utilized on a return trip from Eureka Sound if food or fuel were needed.

Two of the planes succeeded in reaching the mouth of the fiord, but were unable to establish a station, owing to rough water and cross winds.

On August 12 the wind blew so hard from the south that nothing could be done. We spent the day watching the planes to prevent them from going adrift and in picking up empty barrels, boards, and half of the raft, used by the mechanics in working upon the planes, which a rough sea around the *Peary* had torn loose and thrown on the beach.



Photograph by Jacob Gayer

THE ONLY ICE PACK ENCOUNTERED ON THE RETURN VOYAGE

Summer sun and heavy seas had broken up the notorious Melville Bay ice, and the *Pravy* made her way through this broken field with little difficulty.

The 13th was our unlucky day. Everything that had not happened previously seemed to occur then. The day was ushered in with a gale from the northeast, which later veered to the north. At 5:30 a. m. a boat broke loose from the *Peary* and went drifting seaward. With very little hope of ever recapturing it, I went after it in our 12-foot rowboat. Just outside of Etah Harbor I found it dashing on the rocks, half filled with water.

This salvaged, I reached the *Bowdoin* in time to see the *NA-2*, fastened by a long rope to the stern, slowly sinking, her seams having started in the rough sea. She was not to be outdone in the dramatic manner of her sinking. Bow first is the custom with big ships, and bow down she went, lifting her red, white, and blue tail high into the air, ready for the plunge (see, also, text, page 529).

Instant work by John M. Jaynes, my engineer, and Ralph P. Robinson, my mate, saved her. Rocheville, a Navy mechanic, who was always on his job, immediately freed the forward compartment of its load of plane equipment and water. Pumps were started and in a few minutes the *NA-2* was riding lightly again, but since the engine was filled with salt water a new one must be substituted.

A few minutes after this incident a volume of black smoke rolled up from the forward deck of the *Peary*. With her decks loaded to the rails with gasoline, was she on fire? A blazing bundle of waste was tossed over the rail; the fire was out.

THE FIRST CACHE IS LANDED 107 MILES FROM THE SHIPS

The day ended with floe ice endeavoring to carry two of the planes out of the harbor. As a miniature berg scraped and crunched along the side of the *Peary*, Rocheville sat on the end of a plane wing with legs stiffly extended to ward off the enemy and save the fabric. This plane safe, we turned our attention to the *NA-1*, directly in the path of two small bergs driving fast before the wind. Our motorboats dragged the plane to one side, letting the bergs pass on their way out to sea. So ended one day in the Arctic.

With the *NA-2* now disabled, the *NA-1* and *NA-3* got away on the 14th

and succeeded in landing their first cache of supplies at the head of Flagler Fiord, distant from the ship 107 miles. They returned to Ellesmere Island in the evening, but were unable to leave anything additional because of drift ice. A realization of the fact that, because of prevailing ice conditions in the North, no dependence could be placed upon a supply station once established was a severe blow to the plans of the Naval unit.

From my sledging experience and also from the reports of the natives, I had confidently believed that all of Flagler Fiord and Eureka Sound would be suitable for landing throughout the summer months.

SECOND CACHE LANDED ON SAWYER BAY

August 15th was a beautiful day. The *NA-1* and *NA-3* got away at 10:45 p. m. in another attempt to land supplies at the head of Flagler Fiord, and, if weather conditions permitted, to go on into Cannon Fiord. At 8:30 the next morning they were back, reporting that Flagler Fiord was inaccessible. They had therefore gone on to the head of Sawyer Bay, on the north side of the Bache Peninsula, and had there left a small cache. (See Map of the Arctic Regions, supplement with this number of the NATIONAL GEOGRAPHIC MAGAZINE.)

The afternoon of the 17th was the finest we had had since leaving Labrador. Unfortunately, the *NA-1* required a new engine and the *NA-2* was permanently disabled.

Work continued on the third of our planes in the vain hope that something might yet be done. On the evening of the 17th, from the deck of the *Bowdoin*, some 200 yards distant, we noticed flames under the stern of the *Peary*, close to the *NA-3*.

It proved to be a fire on the water—burning gasoline which had overspread the surface. Before it could be extinguished, one wing of the imperiled plane was so badly scorched that it was decided to substitute a new one. To remove her engine and replace one wing would require at least three days.

Such happenings should not be credited to carelessness, for they occur from engine back-fire, repair torches, etc.



Photograph by Maynard Owen Williams

IN BEADS AND BOOTS

In south Greenland the chief charm of the women's costumes lies in bright red or blue boots, with mosaics of varicolored leather down the front, and in heavy bead collars, each weighing two pounds or more and each woven in a pattern devised by its wearer. Christina, whose photograph this is, would not like to be called an Eskimo, nor should she be, as the present population in the chief Danish settlements contains little Eskimo blood.



Photograph by Maynard Owen Williams

AN IMPROMPTU MOVIE CROWD ON THE DECK OF THE "BOWDOIN" AT HOLSTENSBORG

Wherever there were lonely missionary workers or curious natives along the route of the *Bowdoin* and the *Pearcy*, motion pictures were shown. In Etah the perpetual daylight made it necessary to darken the forecastle, but the total native population of 15 souls did not overcrowd the narrow space. Here, at Holstensborg, the nights were dark enough, so that the pictures, chiefly of Arctic scenes photographed on former trips, could be exhibited on the deck of the *Bowdoin*.

It was now August 18. As a result of 18 days' work, two small deposits of food and fuel had been advanced 107 miles only. All spare motors and three spare propellers had been utilized. One plane only was now available for flight and her wireless equipment was not in working order.

Under such conditions, although Commander Byrd was eager to take the remaining plane, unattended, across Smith Sound and possibly over Ellesmere Island, a forced landing and inability to take off again, or serious motor trouble, would have resulted in a delay in starting for home and possibly both ships, wholly unprepared for wintering in the Arctic, might be imprisoned for a year. I therefore vetoed the daring proposal.

In 18 days the planes had been able to land at a point only 107 miles from base in the direction of our goal—the vast unexplored area lying between Alaska and the North Pole. Could they pos-

sibly fly 2,000 miles in the remaining 10 days? Yet this distance must be covered if airplanes were to do work left undone by us with dogs in 1914-17. Figure weights and cruising radius of planes as we could, even eliminating all possibility of accidents, there seemed no way that the task could be accomplished before September 1.

FLIGHT WORK IS TERMINATED

We might have reached Axel Heiberg Island and the edge of the Polar Sea, but nothing was to be gained by that. The Expedition had other worthy objects in view, and these would be daily sacrificed to no purpose. To delay even one week might result in failure of all our program.

Our photographers and scientists had been very considerate and patient, and had done everything possible to further the plans for putting planes beyond the limits of the known, yet they were all of



Photograph by Maynard Owen Williams

SEEING HERSELF AS THE GEOGRAPHIC SEES HER

In 1924 Commander MacMillan took a photograph of this Holstensborg girl, which was published in the NATIONAL GEOGRAPHIC MAGAZINE for June, 1925. Nothing gave as much pleasure to her on the return of the *Bowdoin* as to see her own picture, taken the year before.

one accord that nothing could be gained by remaining longer at Etah. I therefore requested Commander Byrd to give up all plans for future flights across Smith Sound and make ready to return home.

Knowing from past experience that from now on Etah Harbor would be very inhospitable, that we could expect bad gales of wind down the fiord from the Greenland ice-cap directly upon our little aviation beach, it seemed wise to dismantle the two planes at Igloodahouny, in Robertson Bay, to the south, and therefore it was suggested that they fly down to this Eskimo settlement. The *Bowdoin* proceeded at once to await their arrival, but that night Gayer and his pilot, while securing aerial views over Smith Sound, barely reached Etah in safety, and the plane was utterly unable to fly down the coast.

Our decision to terminate our flight work seemed to be justified. The planes simply could not do the work required of them, at least not until the conditions so new and trying to planes had been studied and corrected.

E-TOOK-A-SHOO TAKES HIS FIRST AIRPLANE RIDE

The *NA-1* arrived at Igloodahouny at 10 a. m. on the 22d. At eleven, with Bennett as pilot, I left for the Eskimo village of Karna, 25 miles to the southeast, to visit my old dog-driver, E-took-a-shoo, and bring him back by plane if he cared to come—a new experience for one whose career with me has ever been varied.

The waters of Inglefield Bay were so filled with ice that for the moment I doubted if Bennett, expert as he is, could make a landing in such rough water, for the wind was blowing at least 40 miles an hour. He dropped prettily between the drifting ice pans, lowered his wheels, by motor, and taxied up to a rocky shore, enabling me to land from one wing.

E-took-a-shoo was there, all smiles.

"Get your mittens and come on!" I yelled. Without inquiring where we were going, he turned and ran to his tupik (sealskin tent).



Photograph by Maynard Owen Williams

SEWING A TOP DECK ONTO A SUKKERTOPPEN KAYAK

The kayaks, or hunting boats, of the Greenlanders of Sukkertoppen are among the lightest, most graceful,* and most easily handled of all those in the North. Sealskin, sewed on with reindeer sinew, forms the covering for a light wooden frame. The man standing is holding the hoop with which the opening is surrounded. The waterproof leather shirt is tied tightly about this, so that when the Greenlander puts to sea he and his boat form a single water-tight unit.

He came out, followed by his wife, looking a bit bewildered, and climbed into the rear seat, and we were off—he didn't care where.

As far as I could detect from his emotion, he had always been in the air. His trust in the infallibility of the white man's creation and the man who handled it was most interesting psychologically. He and In-you-gee-to, who flew at Etah, as far as I know the only Eskimos in the world to fly, will have much to tell during the coming winter, when they harness their dog teams and drive about, making those delightful visits with which the night-bound Eskimos pass the long winter.

PLANES FLY OVER GREENLAND ICE-CAP

Our flight work terminated with a short trip by Commander Byrd and Bennett up Robertson Bay and in over

the Greenland ice-cap. The *Peary* arrived on the morning of the 23d. Leaving orders for her to follow the *Bowdoin* down the coast, we proceeded to Karna to land E-took-a-shoo.

The waters of this part of the North are almost wholly uncharted. Off the Redcliffe Peninsula (the tongue of land between McCormick Bay and Inglefield Bay), however, there is a dotted line indicating shoals. I might have known that this was put there by Peary and meant something definite, but a careful examination from the air on the day before failed to reveal any dangers.

We were going at full speed about one mile off the beach when there came a tremendous crash, hard enough, it seemed, to rip the whole bottom out of our staunch little ship and sounding especially violent to both Robinson and myself, who were down in the cabin don-



Photograph by Maynard Owen Williams

ALPINE SCENERY IN A GREENLAND FIORD

The *Borudoin* is anchored in the tiny harbor in front of the village of Kornok, on Godthaab Fiord, between Godthaab and the Norse ruins. In the right foreground are two kayaks set bottom side up on stands to keep the sealskin covering from rotting.

ning oilskins in anticipation of a heavy rainstorm approaching from Inglefield Bay.

We scrambled up the ladder to the afterdeck. One glance was sufficient. We were high and dry, as a sailor would say, and so high forward that I knew we would not come off until the next tide (see illustration, page 504).

The all-important question right then was, "What kind of a bottom are we on?" If on ragged rocks, the *Bowdoin*, with her heavy deckload of 39 barrels of gas, might suffer considerably in spite of her staunch construction of white oak, armored with ironwood and backed with cement.

Over the rail the gas must go, and over it went, into a choppy sea, the heavy steel drums drifting rapidly off to leeward. Full speed astern was of no avail, for in the meantime the tide had dropped.

"Why not fasten the barrels together and anchor them?" one bright member of my crew suggested. Within one busy, soaking hour all but six had been captured and fastened to anchors.

THE "BOWDOIN" COMES OFF THE ROCKS

To receive a serious injury to the hull of the *Bowdoin* 3,000 miles from home might place us in a predicament. It would relieve us of considerable anxiety to have the *Peary* standing by, in case we were in need of her help. She received our signals and rushed to our assistance.

Meanwhile the *Bowdoin* had listed so heavily to starboard and was so high on the rocks that we could walk under her prow and make an examination of her keel. We found the shoe almost completely gone and the keel itself so badly split and splintered that we trimmed off large sections with an ax. But, knowing the thoroughness of her construction, we had no fears whatever as to her seaworthiness for the homeward trip.

To watch the incoming tide flow over her rail and up the slanting deck was no new experience. It had happened in 1923 and 1924. We knew that she would rise as she did, and within an hour we were afloat and chugging along in search of anchored barrels. All but six were found and reloaded, and we proceeded to Karna, to land E-took-a-shoo.

Two hours' anchorage here convinced us that no ship should ever call at this port. Under the pressure of a strong northeast wind, great blocks of glacial ice came down across our anchor chain, threatening to pick us up bodily and sweep us down Inglefield Bay.

We were glad to up anchor, snap the bells, and scud before the wind for Cape Parry.

In the next two days, bucking strong head winds and heavy seas, and encountering fogs and snowstorms, both ships groped their way southward.

A last good-bye at a small encampment must be made if possible to deliver a few presents sent north by Miss Miriam Look, of Hope, Rhode Island.

From the crow's nest a landing seemed impossible because of closely packed ice. A small boat would never do it. Therefore I decided to work the *Bowdoin* in through the pack.

With Lieutenant Rigg, of the United States Coast and Geodetic Survey, throwing the lead whenever he could find an opening in the floe ice, hugging close to our hull, we sounded our way within 100 yards of the shore, and then, accompanied by Maynard Williams, who was always eager to embrace every opportunity to secure photographs for the NATIONAL GEOGRAPHIC MAGAZINE, I landed upon the rocks, not without difficulty, owing to a heavy swell, following the recent gale.

It was up and down, grab and hold. With the help of the natives, who were especially active when they saw biscuit, tobacco, and other presents in the boat, we finally succeeded in getting a footing, and within a few minutes were surrounded by the whole contingent of men, women, and children.

Here was a summer encampment but a decidedly winter scene, a rare opportunity for Williams, who took advantage of every minute we could spare. A final "Good-bye!" and we were in pursuit of the *Peary*, far off in the ice fields, speeding south for home.

HOLSTENSBORG, UNIQUE PORT OF CALL

Our next stop was at Holstensborg, the most interesting settlement in the Northern Inspectorate of Greenland. Years ago it was the home port of the



Photograph by Maynard Owen Williams

A GREENLAND UMIK, OR WOMEN'S BOAT

These seemingly unwieldy craft, made of sealskin, rowed by women and steered by some graybeard of the community, are not seen as often as in former years; but when the boat and bead girls were asked to parade their umiak they readily launched it and drove it past, even when the wind in the sails opposed their efforts. From youth the Greenland women are strong wielders of the oar, and large boats can be seen in charge of mere infants, who, of course, cannot swim, the water being too cold to invite surf-bathing.

American halibut fishermen, some of whom are buried in the little cemetery overlooking the harbor. Its well-kept, painted buildings nestle among the rounded, rocky hills, each festooned with strings of dried halibut heads, food for the long winter to come. Its up-to-date canning factory is a pleasant surprise and its product, canned halibut, delicious.

Bucking a heavy sea and head wind, we proceeded slowly south along the coast to Sukkertoppen, the most impressive looking village that we visited in Greenland, with its popular Kolonibysterer, or Governor, Mr. Christian Langskov. No less popular was his congenial wife and even more so to the younger members of my party was his charming daughter, Ebba, twenty years of age.

Within a few minutes of our anchoring Governor Langskov visited the ship and gave us the "keys of the city," so to speak, and throughout our stay he was unrelenting in his care and attention to every detail of our comfort.

Sukkertoppen might well be designated "The Venice of Greenland," situated as it is upon a collection of peninsulas and islets connected with bridges. So attractive did some of my men find this settlement that they declared that they would gladly remain there for the winter.

At Godthaab the *Peary* recoiled and since she was to go direct to Battle Harbor I made additions to the *Bowdoin's* crew by taking on Dr. Koelz and Jacob Gayer.

Koelz is the most energetic naturalist I have ever known. I believe that he accomplished more during the summer than many scientists in the North have done in years. Among his collections are 1,500 bird skins! And these in addition to fish and flowers galore!

THE ARCTIC'S COLORS PHOTOGRAPHED FOR THE FIRST TIME

Gayer, the color photographer of the National Geographic Society, has succeeded in obtaining natural color repro-

ductions of Arctic life and scenes—the first ever to be made north of the Arctic Circle.

Gayer learned the necessity of keeping his plates cool while taking pictures of cacti for the National Geographic Society in New Mexico,* where a vault in a stone courthouse was the only safe depository for his autochrome plates when the temperature stood at 103° in the shade. But when he insisted on taking an electric fan to the Arctic his friends laughed. The explanation lay in the fact that color plates must be dried rapidly if their tints are to remain faithful.

The amateur may consider his small kodak a burden, but Gayer thought nothing of shouldering a 60-pound load in Greenland and walking miles with it, climbing slippery hills over treacherous rocks in pursuit of his color records.

The costumes of the Far North, the markings of new species of trout just as they are taken from the water, the red lichen which one finds on Arctic snow, the elusive tints in glacier and iceberg—these have been recorded on a photographic plate for the first time.

The cheery character of the Eskimo has been the cause of frequent comment, and such cheer as is faithfully recorded in color in Gayer's plates is truly contagious. Out of the frozen North to which he took a paradoxical but necessary electric fan, he has brought a record of smiles that will warm the heart of every admirer of his difficult but eminently successful work.†

Members of The Society may remember that one of the objects of our expedition was a study of the Norse ruins of Greenland, really the first chapter in American history. Near Godthaab was situated the so-called Western Settlement of the Norsemen, consisting of about 90 farms and 4 churches, and Governor Simony kindly appointed Doctor Børresen, resident physician, as our guide to a Norse building discovered some years ago, the best now standing in the Western Settlement.

* See "Canyons and Cacti of the American Southwest" in the NATIONAL GEOGRAPHIC MAGAZINE for September, 1925.

† Many of Mr. Gayer's natural-color photographs made in the Arctic will be reproduced in an early number of the NATIONAL GEOGRAPHIC MAGAZINE.—EDITOR.

The Godthaab Fiord is 60 miles in length and as beautiful as it is long, revealing a composite picture of Norway and Switzerland—the fiords of the former, the snowcapped peaks of the latter. It was interesting to know that within a few yards of the shore we were sailing in waters nearly 2,000 feet deep; that some of the peaks towered almost from the water's edge to more than 5,000 feet in height! And more interesting was it to realize that we were sailing the same waters traversed by the hardy Vikings in their high-prowed open boats more than 900 years ago!

THE FIRST GLIMPSE OF NORSE RUINS

As we approached the head of the fiord and beheld the glaciers descending from the great Greenland ice-cap we were "all eyes" for our first glimpse of a Norse ruin. In the gathering twilight it was very distinct—a square rock building, standing in the center of an elevated plain 100 feet above the water's edge.

It was with a feeling almost of reverence that we stood at the open door of what had apparently been a church, a beautifully built and well-preserved rock structure, in size roughly 20 feet square, with walls 10 feet in height. Its roof, probably of logs and thatched with turf, was missing (see page 516).

If it did serve as a church, naturally arises the question, "Why not windows?" In lieu of these we discovered small port- or peep-holes, for it is hard to conceive how anything, even arrows, could have been hurled through such small openings. I am informed by some of the Danish officials that churches served the double purpose of worship and defense, and it is possible that the Norsemen went to service, as our Pilgrim forefathers in New England did, with weapons in their hands.

Within a few yards of this structure were the remains of several buildings and also the rock outlines of their stockyards and barns for cattle, which we know they had—sheep, goats, and cows.

What little we had the good fortune to see—and we are extremely grateful to the Danes for this privilege—whetted our appetites for more and for further investigation in the future.



Photograph by Maynard Owen Williams

THE PRINCIPAL NORSE RUIN AT THE HEAD OF GODTHAAB FIORD

The farmer-sailor Norsemen had two colonies in south Greenland. This fortress-church at Ujaragssuit is one of the finest of the ruins in the smaller of the two settlements. About 20 feet square and 10 feet high, it is made of uneven slabs forming smooth exterior and interior walls with smaller rubble between. The land about this ruin is now a swamp covered with dwarf trees and bushes (see text, page 515).

We reached Godthaab on the night of September 17, feeling well repaid for the 120-mile run of the *Bowdoin*.

On the morning of September 21 we were away for Labrador with a fair wind and fairly good weather, but in the evening a gale came in from the northeast and east, with a driving rain and heavy sea.

After a stormy passage the Labrador hills of Cape Mugford loomed up through the driving mist, their tops white with new snow on the morning of the 24th. Appreciative of the fine harbors which had sheltered us in the past, we struggled against wind and sea to get up under the land before dark—a vain hope. We were forced to square away down the coast for Jack Lane Bay. At midnight we caught the welcome 2-second flash of Cape Harrigan, our first lighthouse since leaving the Labrador coast on July 19.

There was great rejoicing at the Bromfield home, on Jack Lane Bay, as we anchored in front of the door. Only that

morning the family had discussed the lateness of our return and had given us up for the year, fearing that our good little ship had been frozen in the pack ice of the Far North.

No time to be lost. We were under way at daybreak, bound south for the Moravian settlement at Hopedale. Here we rid ourselves of that frightful load of Navy gasoline.

The *Bowdoin* was now a different ship. Her decks were clear. She was stripped for action.

Driving before rain and wind, the ship swept down the Labrador coast a frightened bird.

Off Cape Strawberry our main gaff snapped, but a new one, ordered by radio, awaited us at Battle Harbor.

Only one night here to fit our new stick and lace on the sail and we were away, heading down through the Belleisle Strait for home.

As we entered the harbor of North Sydney on the morning of October 6,



Pacific and Atlantic Photograph

THE "BOWDOIN," MACMILLAN'S FLAGSHIP, ARRIVING AT WISCASSET, MAINE, ON HER RETURN FROM THE ARCTIC

At the mainmast is the Stars and Stripes, at the foremast the flag of the National Geographic Society.

with the Stars and Stripes at the main and the National Geographic Society flag at our fore, we were instantly recognized by the various craft and saluted by several steamers, all of which we answered with our air whistle.

When half way up to Sydney we descried a powerboat awaiting us, one occupant of which was vigorously waving a large American flag. The National Geographic Society was the last to bid us Godspeed in early July, through its President, Dr. Gilbert Grosvenor, who accompanied us as far as Battle Harbor. It was the first now to welcome us home through its representative, Mr. J. R. Hildebrand.

No sooner were we docked than a throng gathered around the schooner.

Within four hours all of my men had received much-needed hair cuts, had enjoyed apples, bananas, grapes, and peaches; had read their mail and were ready for home. The *Bowdoin* had taken on one thousand gallons of fuel oil and declared she was ready for our last 500 miles.

We cast off lines at 1:30 and proceeded down the harbor and out to sea with a smashing fair wind.

If wind and sea had remained from the same quarter, we would have had a comfortable night, but as darkness came on,

the wind whipped around from the south-east to northwest, with vivid flashes of lightning and driving rain. A nasty cross sea caught the *Bowdoin* from every direction. She shipped tons of water over her bow and over both rails, threatening to wash some of my men overboard.

We finally shortened down to a foresail alone, to ease ship a bit. In taking down our forestaysail, or jumbo, Salmon was almost completely buried by a sea which swept over the bow, and Melkon was taken off his feet. Working in the pitch dark, they did well to remain on deck.

A CLOSE CALL

Fearing for their safety and not hearing a sound above the roar of the wind and rush of waters, I left the wheel for a moment and ran forward to learn if they were still there. I found them tugging on the sail, endeavoring to lash it down to the boom. I had no sooner reached the wheel than the third member of my watch, Rawson, our fifteen-year-old cabin boy, was knocked down by a sea which swept aft along the deck, flush with the low rail—a close call.

At this moment the ominous slatting and banging of a sail revealed that the lacing on our foregaff had given way. This meant the loss of our most valued sail unless it could be taken in at once.

"All hands on deck!" and up they came with a rush, showing that each man had tumbled into his bunk "all standing," as we say at sea.

No man on shore can properly visualize such a scene—roar of wind, swash of waters, snap and crack of canvas and ropes—a little ship buried in froth, dark oilskin-clad forms working rapidly here and there, the blackness punctuated with orders from the officer in charge, as wave after wave reached over the rail, ending with a thud against lifeboat or cabin.

With engine full speed ahead, we were dropping backward, and there were times when the *Bowdoin* seemed to have decided to go back North. She headed east and fairly ran away with the bit in her teeth and her jaws frothing.

But the next morning was glorious—a beautiful fall day, and good weather.

All day we raced along in under the land—a glorious sail—with the *Peary*, which had been awaiting us at Halifax,

slowly creeping up. Not until we rounded Cape Sable, however, and were well in toward Seal Island, on the last leg of our voyage, did she forge past us, her lighted cabins giving her the appearance of an ocean liner. Three long blasts of her whistle ended the race, as she crept ahead and disappeared into the night, heading up for Monhegan Island, off the Maine coast, nearly abreast of Wiscasset.

It may be of value to those who are interested in birds to know that all the next day various species came fluttering to our decks and rigging. Many of them were easily caught in the hand, although apparently not exhausted. Among them Dr. Koelz recognized the chipping sparrow, junco, ruby-crowned kinglet, black-and-white creeper, and myrtle warbler. Some of them flew down into our cabins, into the engine room, and even spent the night in our bunks.

At 5 o'clock in the afternoon we caught the faint outlines of Monhegan and headed for the southern entrance. As we entered and ran through the harbor, we were saluted by the *Peary* and by the islanders crowding the dock.

A GALE AT HOME PORT THRESHOLD

We had arrived on time and were ready to leave for Wiscasset the next morning; but the next morning had no intention of permitting us to leave. At 5 a. m. I was aroused by the slatting of the hal-yards and the roar of the wind through the rigging. The gale increased in strength through the morning and by mid-afternoon we were in the center of a chaos of white water. Up to this time we had been anchored behind a ledge. I decided to go around into the harbor itself. Well we did, for that night Monhegan, with other parts of the American coast, experienced a real gale.

Sunday was little better. It was the irony of fate that, within 30 miles of home and thousands of people awaiting our return, we were unable to reach the mainland, but at 6 a. m., October 12, the *Peary* and the *Bowdoin* steamed out of the island shelter and at 9:30 anchored in Wiscasset, to be met by Governor Brewster of the State and by hundreds of people crowding docks and streets.

We were home!

FLYING OVER THE ARCTIC

BY LIEUTENANT COMMANDER RICHARD E. BYRD, U. S. NAVY (RET.)*

COMMANDING OFFICER, U. S. NAVAL AVIATION ARCTIC UNIT

AVIATION will conquer the Arctic—and the Antarctic, too. But it will be difficult and hazardous. These things, however, only increase the extraordinary lure of the Polar regions.

It seems fitting that the United States Navy, so prominent in Arctic history, and the National Geographic Society should have joined hands last summer in Arctic exploration by aircraft. This work will not end until all the wonderful records made by the dog sledges have been surpassed and the heart of the great unexplored area reached—an area, containing a million square miles, which has so far baffled all attempts to penetrate it.

The world was determined that the North Pole should be reached, and now it will not be content until the secrets of this unexplored area are revealed.

Peary's great achievement was the culmination of centuries of effort, where tragedy was frequent and failure the rule. But each tragedy and each failure, along with each success, was a stepping stone for the next explorer who came along.

So it is with exploration from the air. The MacMillan Expedition has, we hope, taken aviation conditions in the Far North out of the column of the unknown, and we believe that in the air battle with the Arctic elements last summer we learned some facts of value to all future aviators in Polar regions.

At 5:30 a. m., August 2, the morning after the *Peary* reached Etah, the eight officers and men comprising the Naval Aviation Unit started to work, with the

enthusiastic assistance of Commander MacMillan, the Eskimos and all hands, building with the airplane wing crates a runway for the planes on the ridiculously inadequate beach (see illustration, page 522).

PLANES ARE ASSEMBLED IN THREE DAYS

Working in the open on the delicate parts with bare hands, and at times exposed to snow squalls, my men got the wings and disassembled planes to the beach, erected and flew them by August 4. The rapidity with which they did this is still a matter of wonder to me. With any other planes than the Loening Amphibians, with their combination wheels and boats, I do not see how the flying ships could have been dragged up on land.

The beach proved entirely too small and soft, so we moored the planes out to buoys, which were dropped several hundred feet offshore. We thereafter operated entirely from the water.

Some of the gales which the planes had to ride out in the harbor were so severe that our anchors, which ordinarily would have held planes twice the size of our amphibians, dragged, and it became necessary to keep the planes most of the time tied up astern of the *Bowdoin* and the *Peary*.

Almost invariably our hours of sleep were interrupted by the deck watch with a report that one of the buoyed planes was dragging anchor, that the wings of another were about to strike the ship's side, or that a miniature iceberg was bearing down upon a third.

The weather being calmest from midnight to seven or eight o'clock in the morning, we frequently flew during the night hours.

On August 4 we took our ten specially picked carrier pigeons ashore in the pigeon house, to get them oriented to the locality (see illustration, page 524). On the 10th we turned them loose, but only four of them returned. Chief Aërographer Francis, who acted as Navy pho-

* Commander Byrd had charge of the navigational preparation for the transatlantic flight of the NC flying boats, the *NC-4* being the first craft to accomplish the voyage by air; he was assigned as one of the navigational officers of the *ZR-2* for her proposed flight across the Atlantic from England to America; he prepared navigation data for the *C-5's* proposed first transatlantic flight by dirigible. This last-named flight was to have been from Newfoundland to the British Isles. The ship flew from New York to St. John, New Brunswick, and was there destroyed by storm. The author served as lieutenant commander in naval aviation during the World War.—THE EDITOR.



Photograph by Maynard Owen Williams

THE CHIEF OF THE NAVY PERSONNEL, WITH THE BUMSTEAD
SUN COMPASS

Lieutenant Commander Richard E. Byrd, Jr., who had charge of the Navy unit, is here seen in Arctic flying costume. The sun compass was invented by Chief Cartographer Albert H. Bumstead, of the National Geographic Society staff. Because of the variations of the magnetic compass (see red arrows, the Arctic Regions map supplement) and the weakness of magnetic force in the Arctic, this sun compass, which can be used in clear weather throughout the mid-summer months, was found of great value (see text, page 523).

tographer, meteorologist, and pigeon man, reported to me that they had been killed by Arctic falcons.

It would seem, then, that pigeons are not practicable for communication purposes in that part of the Arctic. We had thought that they might be used for communicating with Etah in case of a crash, if our radio was put out of commission.

We spent August 5 making radio tests and full-load tests. We found that, with

the load of food, rifles, ammunition, boat, etc., stowed in the tail, a plane was thrown out of balance, so we spent the 6th taking a 33-gallon emergency gasoline tank out of the bow to make room for stowing the gear. At 7:00 p. m., August 6, fog descended, visibility became very poor, and it began to rain. The downpour continued for 24 hours, after which a southwest gale sprang up. This blow turned into a snowstorm the following day at 2:00 p. m.

ONLY 15 DAYS LEFT
FOR FLYING

From general conditions and information supplied by the Eskimos, it was realized from the first that we were having scarcely any summer at all, so the Naval unit put forth its greatest effort in accomplishing its work in the shortest possible time. In fact, it turned out that after the planes were ready for flight there were but 15 days of "summer" in which to accomplish our mission.

It is an astonishing fact that of those

15 days only three and three quarters were good for flying; two were fair flying days and one indifferent. More than half the time was either dangerous or very dangerous for flying. Yet the three planes flew more than 6,000 miles, 5,000 miles of which were flights from Etah on the work of accomplishing our mission; and we saw 30,000 square miles from the planes, a large part of which, being inaccessible to foot travelers, had never before been

seen by human eye. Our first reconnaissance flight was to Cape Sabine, which lay on our proposed course toward the Polar Sea, 30 miles from Etah. We found that the ice began several miles north of Etah, and covered all the water to the northward as far as we could see.

FLYING WHERE FORCED
LANDING WOULD HAVE
MEANT A SMASH

We flew low on that trip, hoping to find the ice smooth enough to land on, but it was rough and corrugated, and in such condition that landing upon it would have been as disastrous as landing among large rocks—a plane would have been completely demolished and, of course, the flyers probably would not have been able to walk away from the wreck.

We realized that the ice-landing skis which we had brought to use in place of wheels would be of no use to us under such conditions. There were pools of water on the ice and here and there open leads filled, more or less, with detached pieces of ice. It was easy to see why Ellesmere Island is inaccessible in the summer to the dog-sledge travelers.

ENGINE CHANGED WHILE PLANE BOBBED
ON WATER

In all the hundreds of square miles of ice over which we flew later on, we did not see a single place on the ice where a landing could be made without disaster!

The engine on the *NA-1* had developed



Photograph by Jacob Gayer

THE FIRST AMPHIBIAN LEAVING THE "PEARY" AT ETAH

The three Navy planes were stored during the voyage from Boston on the narrow after deck of the *Peary*. Lowering them to the water, floating them to the rough, stony beach, and putting on their wings with Eskimo help was an extraordinary, if not unprecedented, feat, while changing the 900-pound engines in the planes, as they were tossed on the waves below the boom which supported the machinery, was an even more remarkable achievement.

a knock on the 5th and we decided to put in a new motor, for we felt that we had to do everything humanly possible to prevent a forced landing on the ice. The mechanics shifted the 900-pound motor with the rather jerky ship's boom, while the plane bobbed up and down in the water alongside the ship. I watched the men work, but it is still a mystery to me how they did it.

Bennett and Sorensen worked all day and all night connecting up the intricate



Photograph by Maynard Owen Williams

THE FIRST NAVY PLANE TO BE ASSEMBLED ON THE NARROW, ROCKY BEACH AT ETAH

This view, taken in a drizzling rain on August 3, shows the *NA-2* almost ready to take the air. Runways constructed of the sides of the wing boxes lead down into the water, which is near high tide. The wings for the two other planes are seen to the right, and in the distance is the pigeon house in which the Navy pigeons were kept (see, also, page 524).

mechanism of the motor, out in the cold and the wet, and reported the plane ready on the morning of the 7th. The work had been accomplished in about one-fourth the time I expected it to take. When the motor started and hit on all twelve cylinders, it was a very pleasant surprise. Then Bennett and Sorensen reported ready to fly! Rest seemed to mean nothing to them. But the weather was nasty and I made them turn in.

That is the kind of spirit every one of the officers and men with me displayed. No handicaps—and there were plenty—were too great for them to overcome. Any operation of planes at all in the Far North last summer was necessarily difficult, and no ordinary effort would have enabled us to cover 6,000 miles—a feat which evinces the great courage, indomitable spirit, and unusual ability of the personnel with me.

At 4:00 a. m. on the 8th, during a gale, the *NA-3*, which was tied up to an anchored buoy, barely missed destruction from a drifting iceberg. Later she began

to drag anchor, so we had to tie her up astern of the *Bowdoin*. The bad weather persisted until 7:00 p. m., when I immediately gave orders to prepare for our first long flight into Ellesmere Island to attempt to put down a base. I wish to emphasize the fact that on account of the distance to the center of the unexplored area from Etah, at least one base is necessary and two are advisable.

THE FIRST LONG FLIGHT OVER ELLESMERE ISLAND

We left Etah Harbor at 9:10 p. m., with Schur, pilot; MacMillan, passenger; and Rocheville, mechanic, in the *NA-2*; and Reber, pilot; and myself, relief pilot and navigator, in the *NA-3*. Just before we took off, a herd of a dozen walrus came up a few feet from our plane. They apparently became enraged at it and dived toward us, but we gave the motor the gun and could not see them when they rose to the surface again because of the spray kicked up by the propeller.



Photograph by Jacob Gayer

THE "NA-2," THE FIRST OF THE NAVY PLANES TO BE LAUNCHED FROM THE BEACH AT ETAH, IN THE SHELTER OF PROVISION POINT (SEE, ALSO, PAGE 522)

To the upper right is the *Peary* and beyond her John's Glacier. In the background are Dodge's Mountains, 1,500 to 2,000 feet high, a polychrome tapestry of brown-black rock lightened by bright-orange lichens and with gray high lights formed by the droppings from the millions of little auks which nest and summer in the rock talus.

We set a course for Cannon Fiord, which lies on a line with Cape Thomas Hubbard on the Polar Sea (see Arctic Regions map supplement with this number of the NATIONAL GEOGRAPHIC MAGAZINE), from which Peary in 1906 thought he saw the high peaks of a great land to the northwest.

At last we were to find out whether or not we could navigate a plane where the north magnetic pole is on one side, off to the southward, and the North Pole is on the other side, and where the force of the earth's magnetism that acts on the compass needle is very weak.

I noted immediately that the steering compass did not move at all, but pointed east all the time. Fortunately we had provided a more sensitive instrument, which we called the navigator's compass. It began to swing at first, but after we had

steered a steady course it finally settled down.

In clear weather the sun compass enabled us to do accurate navigation. I was delighted with it. Mr. Albert H. Bumstead, of the National Geographic Society, invented it for our trip and I consider it a great contribution to science (see p. 520).

When we reached Cape Sabine we took a bearing on two points 30 miles apart, the direction of which Peary had established, and found that in addition to the 103° of error caused by our being north of the magnetic pole, there was an additional error of 30°, an unheard-of deviation.

The course we wanted to steer over the ice was northwest, but on account of these errors of the compass we had to steer east by the compass needle. That was a curious sensation.



Photograph by Jacob Gayer

CHIEF AÉROGRAPHER FRANCIS AND HIS PIGEON COOP AT ETAH

As soon as the ships reached Etah, the pigeons were ferried ashore to become accustomed to the surroundings, so that they could bring back messages in case of accident to the planes. After a week the birds were released; all except four were lost (see text, page 519).

As we flew over the ice of Smith Sound, we could see at a glance the area Peary and Bartlett had such a difficult time getting through with the *Roosevelt* in 1908. The thought occurred to me: How we could have helped Peary by indicating to him the direction of the very few open leads of water so easily visible to us, but so difficult to locate even from the crow's nest of a ship! I was impressed, too, with the fact that we were traversing in a few minutes areas that it had taken him days to cross.

We reached Cape Sabine at 9:40 p. m., and passed directly over the spot where 18 of General Greely's men died from cold and hunger. I have never seen a bleaker spot.

A NEW CONCEPTION OF THE ARCTIC'S
RUTHLESSNESS

Over to the northward we could make out Bache Peninsula, which Peary traversed in 1898 and where his hunters killed musk oxen for a fresh meat supply.

After passing Cape Sabine, the view

that opened was magnificent and we were stirred with the spirit of great adventure—with the feeling that we were getting a comprehensive idea, never before possible, of the Arctic's ruggedness and ruthlessness.

I believe that we have a new story to tell of the grandeur of Ellesmere Island. It was evident that the greater part of the land we saw had been inaccessible to the foot traveler, who, keeping largely to the water routes, with the view cut off by the fiords' great perpendicular cliffs, could not have realized the colossal and multifold character of the glacier-cut mountains.

But there was no time to enjoy the view. Any slight engine trouble might require a landing, so I naturally looked about for some suitable place in which to put a plane down if necessary. The landing would have to be made flying at 40 or 50 miles an hour.

I searched carefully and did not see a single place on the land or on the water where a landing would not have meant



Photograph by Jacob Gayer

THE FIRST ESKIMO AIR GUIDE ABOUT TO HOP OFF

The one Eskimo at Etah who can understand English is In-you-gee-to, who was with Peary on his drive to the Pole. His willingness to serve in any way, his industry, and his helpfulness in assembling the Navy planes caused him to be chosen as the first Eskimo to act as an air guide in the Far North.

disaster. The land was everywhere too irregular and the water was filled with ice either broken up into drifting pieces or in large, unbroken areas. At that moment I realized we were confronted with an even more difficult and hazardous undertaking than we had anticipated. I knew, too, that no matter what judgment we exercised we would have to have a little luck to comply with Secretary Wilbur's last admonition to me to bring the personnel back safely. The Secretary had taken a great personal interest in the Expedition.

Commander MacMillan had confidently believed that the fiords would be free of

ice. That they were not was due probably to the fact that we were having scarcely any summer.

We could not use the sun compass, as the sun was obscured, so we continued steering east by the magnetic compass. By sighting astern on known points I was delighted to find that we were almost exactly on our course. A little later, however, the wind-drift meter indicated a strong wind from the north and we had to change course about 10° to allow for it.

No idea of the extremely irregular and rugged character of Ellesmere Island can be gathered from the maps and charts, and many of the mountains we saw were



Photograph by Jacob Gayer

OVER ELLESMERE ISLAND

Cruel in reality, bristling with deadly rock masses and snowy peaks, this little-known land had an eerie fascination for the U. S. Navy airmen. Many of the most spectacular features of the Ellesmere Island scenery were not photographed, for cameras were left behind as "excess baggage" when the planes were loaded with every possible ounce of gasoline for supply bases.

uncharted. The higher mountains were snow-covered and their glaciers extended down to the sea.

SNOW-CLAD PEAKS BAR THE WAY

We continued on to Knud Peninsula (the tongue of land lying between Hayes and Flagler Fiords), flying at an altitude of 4,000 feet. Low-lying clouds hung over the peninsula, with many rugged peaks appearing above them.

Ahead we saw very high snow- and cloud-covered mountains which appeared to be impassable. We kept on, however, hoping to find some way through, but

soon realized that the clouds were so high that no aircraft loaded as ours was could possibly get over them. The weather astern had begun to thicken and the clouds covered most of the landmarks.

Weather conditions change very rapidly in the Arctic, a fact which is of great concern to the aviator, who can not fly through fog and clouds over the land as he can over the sea, since there is great danger of running into a mountain or cliff. Neither can he land and wait for the weather to clear, if he has no landing place! Nor can he keep on flying around, as his gas eventually gives out.

We decided to fly over the clouds and take a chance on finding Etah. Without a landmark it was necessary to steer a compass course. Luckily, we found a rift in the clouds over Smith Sound, with fog only in places here and there on the water. So we were able to make the ships' base without much difficulty, although a 30-mile wind from the north made rough landing.

Upon our return, Aërographer Francis handed me a report that a gale of great intensity was rushing toward Etah from the south. All flying was, therefore, "secured." A driving snowstorm soon set in, bearing out Francis' prediction. The next morning at 3 o'clock a piece of iceberg weighing perhaps 500 tons was driven by the gale between the *Peary* and the planes, barely missing the latter, and giving us some anxious moments.

EAGER VOLUNTEERS FOR EVERY FLIGHT

A few hours later I called the Naval unit together and told them that I would never order any of them to fly over that land again. But when the time came they were always ready and eager to volunteer for any flying that was to be done.

That afternoon it was decided, in conference with Commander MacMillan, that we would try to get beyond the high, snow-covered mountains by going through a gap to the south of our course, even though this was a roundabout route to our proposed Polar Sea base on Axel Heiberg Island.

The gale subsided at 5:30 and we made a reconnaissance and radio test flight to Cape Sabine. We ran into snow over the Cape and found Ellesmere Island completely covered with fog and snow.

The weather cleared toward Ellesmere Island the next morning, August 11, so all three planes prepared to leave immediately for Bay Fiord to attempt to put down a base of fuel, food, and ammunition on its shore. I sent by radio the following report of that flight to the Secretary of the Navy:

August 11th—Three planes left Etah this morning at 10:40. Personnel *NA-2*, Schur pilot, MacMillan navigator; *NA-3*, Reber pilot and Nold mechanic; *NA-1*,

Byrd pilot and navigator, and Bennett pilot-mechanic, for the purpose of locating a landing place to form a base between Etah and Polar Sea.

This base is absolutely necessary, as fuel and food must be deposited on shore of Polar Sea before a flight over it can be made.

Passed over northwest end of Cape Sabine at 11:15. Reached eastern end of Flagler Fiord at 11:45. Altitude of *NA-1* 7,000 feet, *NA-2* and *NA-3* about 4,000 feet. Reached western end of Flagler Fiord at 12:07 p. m. Temperature bitterly cold several degrees below zero at 7,300 feet.

Hundreds of mountain peaks to left all covered with dazzling white snow and clouds covering everything to right, with mountains much higher than shown on chart, as at altitude of 7,300 feet some of the mountains, most of which are not shown at all on maps, were hundreds of feet higher than plane. Saw much land probably never seen before.

At 12:07 set course to 250° true, which made compass course of approximately 12°. Checked magnetic compass with sun compass and found that magnetic compass had 30° westerly deviation, which put compass 170° off the true course. Sun compass very good when sun is visible.

Hit the eastern end of Bay Fiord at 12:45 p. m. The fiord was largely obscured by clouds. That part of the fiord which could be seen was almost entirely covered with ice. At 12:48 *NA-2* disappeared in clouds to the right and *NA-3*, which was having difficulty getting altitude, turned back toward Etah. *NA-1* continued to Eureka Sound southwest of Axel Heiberg Island 200 miles from Etah and found only one suitable landing place, which was on the northern shore of Bay Fiord in approximately longitude 85. (This landing place was only temporary, being an opening in the ice cleared by the wind.)

NA-1 returned to search for other planes, but clouds had closed in behind and had to fly over them. Set course for Beitstad Fiord and found it free of clouds and also ice. Approximately 100 miles from Etah. *NA-2* and *NA-3* reached Etah at 2:30 p. m. and *NA-1* at 3:15. Reber reported that he suffered slightly from snow blindness. All personnel suffered some from cold.

Must take advantage of this good weather, so three planes will start to-night at 9:00 p. m. to establish a sub-base at western end of Beitstad Fiord. Will leave there food, cooking utensils, primus stove, rifle ammunition, and gasoline and oil. Personnel will be the same as for flight this morning except that McDonald will go in *NA-3* instead of Nold and Rocheville in *NA-2* instead of MacMillan. Distances are given in statute miles.



Photograph by Jacob Gayer

SISTER PLANES FLYING OVER ICE-BOUND SMITH SOUND EN ROUTE FOR ELLESMERE ISLAND

Along the Greenland shore fairly wide leads can be seen. What seems a smooth field of ice below is actually ridged into rough hummocks with towering icebergs added like the plums in a pudding. Chief Aërographer Francis is seen outside the cockpit securing a cinema record of this epic Arctic flight.

My joy at finding the *NA-2* and *NA-3* safe at Etah was great.

FIRST LANDING ON ELLESMERE ISLAND

On August 12 I sent the following report to the Secretary of the Navy:

Left last night at 9:30 p. m. for Beitstad Fiord: *NA-3* Reber and McDonald; *NA-2* Schur and Rocheville; *NA-1* Byrd and Bennett. At 10 o'clock *NA-2* had to turn back, due to low temperature of motor. *NA-1* and *NA-3* reached eastern end of Beitstad Fiord at 11 p. m. Did not land in Beitstad Fiord, due to strong cross wind from southwest.

This fiord is magnificent. Its cliffs rise straight up from the water for 2,000 feet. Landed on western end of Hayes Fiord, but strong wind rushing down from glacier made anchoring or taking the plane up to the rocky coastline impossible. Took off and both planes reached ship at midnight.

Have found another spot free of ice where a landing might be made—the western end of Flagler Fiord. Commander MacMillan has agreed to establish a base there as soon as the weather permits. It blew a gale most of the day and Ellesmere Island has been covered with fog.

At last we had been able to land in the interior of Ellesmere Island, but the water



Photograph by Richard E. Byrd, Jr.

VERHOEFF GLACIER, GREENLAND, AS IT APPEARED AT AN ELEVATION OF 1,500 FEET

One of the most thrilling experiences of Navy airmen in the Arctic was the flight over the great Greenland ice-cap. On a day of remarkable visibility the *NA-1* took off from the beach at Igloodahouny and flew directly over Verhoeff Glacier, mounting gradually to an elevation of 11,000 feet, from which the ice-cap could be seen for 100 miles in every direction. It was found that one area to the east attained an elevation equal to that of the plane itself—a greater altitude than had ever been reported for this great sheet of solid ice (see page 532).

had been dangerously rough. We noted on this occasion a very interesting thing. The wind rushed down the glacier, but changed its direction several miles from its foot. We afterward found that no matter what the direction of the wind elsewhere it generally flowed down the glacier and then subsided or changed its direction some miles beyond the foot.

Another interesting phenomenon experienced in the Far North was the difficulty of judging distances—something at which the aviator must be expert. This difficulty was occasioned by the great size of the cliffs and the clearness of the atmosphere—when it is not misty. When we landed in Hayes Fiord we thought we were landing a few hundred feet from the ice fringe on the shore line at the foot of the 2,000-foot cliffs, whereas to our great surprise we found ourselves more than a half mile away.

I shall pass over the operational diffi-

culties we experienced from gales and ice and cold.

After being buffeted by a gale on the morning of the 13th, the *NA-2* began to sink. The engine was half covered with water, but MacMillan and his crew, by prompt and heroic effort, saved the plane. We later hoisted it on the deck of the *Peary* to change the water-soaked motor, but it was never able to fly again.

Having seen open water at the mouth of Flagler Fiord, we decided to attempt to put down a base there. I reported that flight to the Secretary of the Navy as follows:

August 14th—At 11:45 this morning *NA-3*, Schur and Sorensen; *NA-1*, Bennett and Byrd, left Etah for western end of Flagler Fiord, 107 miles from Etah. Reached objective at 1:15 and found at last a place to land in water. Got planes 50 feet from beach and waded ashore with supplies. Deposited, 100 yards from beach, 200 pounds of food and 100 gallons of



Photograph by Maynard Owen Williams

THE "BOWDOIN" AND THE "NA-1" AT IGLOODAHOUNY AUGUST 22, 1925

The approach of winter drove the last of the Navy planes south from Etah to a sandy beach on Robertson Bay. The *NA-1* is here seen on the day of her last flight, when Commander Byrd and Bennett flew inland over the Greenland ice-cap, in a region where Peary did some of his early work in 1892. Behind the flagship *Bowdoin* can be seen the snowy slopes of Herbert Island, near whose shores the narwhal is captured (see, also, illustration, page 500).

gasoline, 5 gallons oil, primus stove, camping outfit, smoke bombs, rifle and ammunition, gallon kerosene and can of matches. At 3 p. m. large block of ice drifted into *NA-1*, but after half hour got her clear. Wind carries ice with great force.

Left Flagler Fiord at 3:35 p. m. and reached Etah at 5:10 p. m.

In order to take advantage of fair weather, as soon as planes can take on gasoline will leave for base and deposit gasoline and oil. *NA-3*, Nold pilot; *NA-1*, Bennett and Byrd. Taking only one pilot in *NA-3* in order to carry more fuel.

On that flight Nold said that he experienced the loneliest time of his life.

IN FEW HOURS ICE COVERS LANDING PLACE

When we reached Flagler Fiord we found that during the few hours we had been away the ice had closed in and completely covered our landing place.

We then cruised about for some 60 miles attempting to locate a landing place in one of the other fiords, but were unsuccessful.

About a half hour before midnight, there was the effect of twilight among the fiords and in the dimness we lost track of Nold in the *NA-3*. Finally we located him, just a speck in the distance and apparently headed for the North Pole! We gave our motor all the power she had and after a good race overhauled him. What Nold's compass was doing, or what he was about, I have never found out, but I don't wonder that he felt lonely.

I had on polar bear trousers, Eskimo boots lined with sheepskin, and a reindeer-skin jacket—the warmest clothes known—but while leaning out of the cockpit to navigate I got very cold.

The next day we started out again. For a week Bennett had had very few hours' rest, but he insisted on going with me. Being the better pilot, he did most of the flying while I navigated and flew from time to time when I was sure of our location, and could let the navigating go for a while.

I made the following report of that flight to the Secretary of the Navy:

August 16th—*NA-3*, Schur and Sorensen; *NA-1*, Byrd and Bennett, left Etah at 10:45 p. m. for Cannon Fiord. At midnight ran into fog and low clouds 105 miles from Etah. Mountains completely covered with fog, so impossible to get over them. Found that the base that we had

put down in Flagler Fiord was still blocked with ice. Found some open water in Sawyer Bay. Landed at 12:15 a. m. and located break in ice foot large enough to beach planes. Ate a midnight lunch and waited for clouds and fog to clear. Thin scum ice formed in places during night. Finally at 4:15 a. m. weather cleared sufficiently to start for Cannon Fiord.

Two planes took off, but Schur, in *NA-3*, landed and signaled that his motor had developed a knock that made it dangerous to attempt to get over the mountains. He was instructed to wait for *NA-1*, which went on alone at 5 a. m. to investigate Cannon Fiord.

At altitude of 5,000 feet cleared mountains shown on chart at 5:20, and got over unexplored regions of Grinnell Land. Found high, uncharted mountains entirely covered with snow. Saw many square miles never before seen by man. There was an uncharted lake frozen over. The jaggedness, irregularity and many deep valleys presented a magnificent but awful spectacle. The air was the roughest ever experienced by us.

At 5:30 reached high peaks that were completely covered with clouds. Made effort to get through, but it was impossible. Returned to Sawyer Bay, reaching there at 6 a. m., and planes deposited 100 gallons of gasoline, 5 gallons of oil and some pemmican. *NA-3* and *NA-1* started return trip at 7:05. Ran into 50-mile gale over Smith Sound and reached Etah at 8:30. Had difficulty tying up to ships, due to very rough water. It has been blowing a gale all day and snowed from 9 to 10 p. m.

Several times on that flight we had almost gone into a tail spin, due to the roughest air I had experienced in nearly eight years of flying. Bennett said he had never encountered anything like it.

FLAMES ENDANGER PLANES

On the 17th the gale finally subsided. At 8 p. m. some gasoline on the water around the *Peary* caught fire and for a few moments it looked as if the *NA-3*, which was tied up astern, and the whole ship would go. Sorensen and Rocheville used splendid head work in casting the *NA-3* adrift immediately and Lieutenant Schur showed great calmness and judgment in procuring a fire extinguisher and throwing it to Nold, who was on the flaming plane.

My diary for the 17th has the following entry:

"The saving of the *NA-3* from destruction by fire to-day was just another example of the fine spirit of the personnel the Navy has assigned to me for this

duty. Whether we succeed or fail, they deserve the highest success. They have overcome almost insuperable odds that the elements and poor facilities have brought about. They have been indefatigable and courageous, and whenever there has been a job to do they have needed no commanding officer to tell them to do it, to spur them to greater effort.

"What they have accomplished on this trip has been almost superhuman, and even if we succeed in the highest measure it can not increase my pride in them. Their attitude seems to have been to live up to the best traditions of the Navy. They never hesitated to spend hours flying over areas where their lives depended entirely on the reliability of the engines."

ONLY ONE FORCED LANDING IN ARCTIC

There was one forced landing during our Arctic work, but it did not come until we were ready to leave Etah, where there was open water.

By the 20th the burned wings on the *NA-3* had been replaced by new wings, a new engine installed, and we were ready to go again; but on that day Commander MacMillan gave orders to get ready for the return trip. He stated that the head of Etah Fiord had frozen over the night before and that a forced landing in Cannon Fiord or Eureka Sound would certainly result in a freezing-in of the planes.

The leader of the Expedition was right. He knows the Arctic, and it is due to his good judgment that the personnel and the planes got back to this country safely.

We were all depressed that we could not go on with our work, for we were learning the location of the few water landing places and we never gave up the hope of accomplishing our mission. With more time and a better season, I am confident that the unexplored area could have been reached.

However, there was another great adventure ahead of us—the flight over the Greenland ice-cap. We spent several days making photographic flights, and on the 22d the *NA-1* and *NA-3* left Etah for Igloodahouny, 50 miles south of us. Reber piloted the *NA-3*, with Gayer, of the National Geographic Society, as photographer, and Nold as mechanic; Bennett, Francis, and I were in the *NA-1*.

A half mile from Etah the engine of the *NA-3* threw her connecting rod and stopped dead. Reber was forced to land and had to be towed back. The *NA-3* was then put on the *Pearcy* alongside the *NA-2*.

I was sorry to see Reber have that hard luck, for, due to serious illness, he had been able to make only two flights over Ellesmere Island. He is one of the most courageous and experienced flyers in the Navy.

FLIGHT OVER THE GREENLAND ICE-CAP

After landing to see that the *NA-3* had gotten down without injury, we continued in the *NA-1* to Igloodahouny, where we found a fine beach. We landed and made camp.

At 3:15 Bennett and I left for a flight over the Greenland ice-cap. The visibility was wonderful that day, and we climbed to an altitude of 11,000 feet. We could see 100 miles in every direction. As we got farther in over the ice-cap it grew bitterly cold, although at 7,000 feet we had encountered a warm stratum of air.

We were flying in a direction a little south of east over a part of the ice-cap never before explored, and we saw in the direction we were going that it reached an altitude equal to that of the plane—11,000 feet—higher than any altitude heretofore reported (see, also, page 529).

To me the Greenland ice-cap is one of the great natural wonders of the world—1,500 miles long, about 630 miles wide, with an area of 700,000 square miles of solid ice and averaging over a mile in height—the world's great iceberg factory.

The glaciers near the foot are greatly crevassed, but farther up, where they join the ice-cap, they are fairly smooth and firm. The shape of the ice-cap seems to be that of the crystal of a watch, so that it would be difficult to land an airplane near its edge without dashing into a crevasse; but 50 to 60 miles inland, though a bit rolling, there seem to be flat places where a plane with skis could land.

We returned to Igloodahouny literally frozen stiff, but we were proud of the *NA-1*, for she had flown more than 2,500 miles in the Arctic in every kind of weather, and she appeared to be in just as good condition as when we started.

HISTORY'S GREATEST TREK

Tragedy Stalks Through the Near East as Greece and Turkey Exchange Two Million of Their People

BY MELVILLE CHATER

AUTHOR OF "REDISCOVERING THE RHINE," "THROUGH THE BACK DOORS OF BELGIUM," "THROUGH THE BACK DOORS OF FRANCE," "THE LAND OF THE STALKING DEATH," ETC., IN THE NATIONAL GEOGRAPHIC MAGAZINE

EVER since the expulsion from Eden, man has been trekking, and folk wanderings are the roots of his history; but with 1922 began what may fairly be called history's greatest, most spectacular trek—the compulsory intermigration of two million Christians and Moslems across the Ægean Sea. Slowly gathering impetus through the centuries, of a sudden these human tidal waves reared and burst on its shores.

This trek, brought about by the startling recuperation of Turkey after her defeat in the World War and her subsequent triumph over the Greeks in Anatolia, eventually developed into a regulated Exchange of racial minorities, according to specific terms and under the supervision of the League of Nations. But the initial episodes of the Exchange drama were enacted to the accompaniment of the boom of cannon and the rattle of machine guns and with the settings painted by the flames of the Smyrna holocaust.

THE FIRST DERELICTS OF THE TREK

The first human derelicts of the Exchange were the Anatolian Greeks, who moved seaward in long files on their 500-mile trek from behind the Turkish Nationalists' lines. Though most of them lived several weeks' walking distance from the war zone, it is conceivable that the Nationalists did not relish having in their rear the distant kinsfolk of their Greek antagonists. And so, through 1920-21, the flow of the deportees, leaving uncounted dead among the snowy mountains and scorching plains of Asia Minor, went on.

For more than two thousand years inner Anatolia had mothered these descendants of the adventurous spirits who had followed Alexander the Great into Asia. A thousand years still earlier its coasts

had been Hellenized by pre-Greeks fleeing from their invaded homeland. Now, exiled from their vine-clad cottages and bazaar booths, the deportees huddled half-naked in seacoast market places, hailing, like castaways, whatever chance vessels might rescue them from the ever-rising waters of refugeedom.

And thus the first 100,000 in history's greatest trek slowly filtered into Greece.

When, in the late summer of 1922, I steamed in between two far-flung promontories, while the sun spilled over Mount Pagos to illumine the vast sweep of red-roofed houses clothing its flanks, I little realized that I was watching one of the last dawns to rise over ancient Smyrna.

Once ashore, on the shipping-crammed quay, my companion and I threaded among camel trains and through narrow streets from whose overhanging balconies two neighbors might almost shake hands.

A climb to the topmost arch of Mount Pagos' crumbled fortifications afforded a view of the outspread checkerboard of Smyrna's sedulously separated quarters—the Turkish marked by minarets and cypresses; the Frankish, outstanding with fine residences, and the Greek and Armenian, crammed with an amazing density of small shops—the whole red-roofed panorama girdled by an illimitable sweep of blue waters which stretched horizonward within the gulf's embracing shores.

A SIX MONTHS' CATACLYSM OF FLEEING PEOPLES

"Let's make a last snapshot of Smyrna," we said, before descending from Mount Pagos. Indeed, it may have been the very "last," since a few weeks later that magnificently outspread scene of peace and prosperity lay in ashes; for upon the Turkish offensive of August 26 the Greek army collapsed on a 150-mile front.



© E. J. Hardcastle

A REFUGEE FROM THE BLACK SEA PORT
OF SAMSUN

He took part in the trek of the "first hundred thousand" Greeks from Asia Minor (see text, page 533).

The ensuing six months' cataclysm of fleeing peoples came as if there had been telepathically broadcast in great waves that swept Anatolia, Smyrna, Thrace, and Constantinople, the instinct of panic. The Greeks in these widespread areas suddenly awakened to find themselves on the brink of a whirlpool.

Refugees from anywhere within 150 miles inland herded seaward into Smyrna. At first they came in orderly trainloads or in carts, with rug-wrapped bedding, some little household equipment, and perhaps even a few animals. But as the distant military momentum speeded up, the influx became a wild rabble of ten, then twenty, then thirty thousand a day. Their increasingly scanty possessions betokened a mad and yet madder stampede from the scene of sword and fire, until September 7 saw utterly destitute multitudes staggering in, the women wailing over the first blows of family tragedy, whereby mothers with no food for their babies had been forced to abandon their older children in wayside villages.

By now Smyrna's broad quay swarmed with perhaps 150,000 exiles who camped and slept there, daily stretching their rugs as makeshift shelters against the sun, whose furnacelike heat was the mere forerunner to a terrible epic of fire.

The American consul general summoned his fellow nationals—the staff of the American college, together with local representatives of relief organizations and commercial firms—and formed a unit, later known as the American Disaster Relief Committee, for the distribution of bread along the quay.

All day long of September 8 and far into the night sounded the tramp of Greece's defeated troops surging toward the transports that chafed under full steam; then these, followed by the harbor's entire shipping, fled seaward. And, like a rising curtain, the dawn revealed only the grim hulls of neutral warships, come to "observe," across that com-

merce-deserted harbor, the catastrophe of Greece's Asian adventure.

A few hours later there came riding into Smyrna and past its close-barred shopfronts a body of Turkish cavalry, black-uniformed and scimitar-bearing, their left hands raised aloft, as in reassurance, while they called "Fear not!" to the white-faced populace huddled in side-alleys.

Before nightfall the whole division was in, with two infantry divisions following.

A DANCE OF FLAMES BECOMES A FIERY HURDLE RACE

A few days after the triumphal entry of the Turks, the army of quay-squatters saw flames dancing in the old, wood-constructed Armenian quarter, a mile and a half away. The dance became a fiery hurdle race, as the wind-fanned flames leaped from balcony to balcony across the narrow streets; then the race became a hungry conflagration whose roaring mouth ate through and gulped down that mile-and-a-half breadth of city down to where the refugee multitude huddled between a waste of fire and a waste of sea.

And now fresh multitudes were disgorged upon them—fleeing Smyrniotes laden, refugee-like, with snatched-up babies and bedding. The city had become a Titanic blast furnace, whose wind-driven flames fanned the quay with so dreadful a heat that the multitudes dipped their blankets in the sea and swaddled themselves. Maddened horses, their harness afire, ran amuck through the press, leaving a wake of crushed bodies, which roasted where they lay.

All afternoon, until the sun died in rayless eclipse behind a cindery pall, and all night long, by the glare, the flood of men and beasts debouched from doomed city upon delirious quay. Affrighted faces mingled with wild-eyed animals, and human cries with the neigh of horses, the scream of camels, and, last, the squeaking of rats, as they scuttled by in droves from the underworld of a lost Smyrna.

Some of the destroyers had crept in close enough for men aboard to behold pandemonium's silhouette against a two-mile frontage of leaping flame, to sicken at the unforgettable odor of Smyrna's hecatomb, to catch the shrieks with which



Photograph by Ernest B. Schoedsack

AN ANATOLIAN GREEK GIRL, OF KONIA

She is wearing the parti-colored costume which was fashionable a hundred years ago in the Greek colonies.



Photograph by Ernest B. Schoedsack

ANGORA, THE "BOOM TOWN" OF ANATOLIA

Since it has become the capital of the Turkish Republic, this ancient inland city, 220 miles southeast of Constantinople, has experienced a mushroom growth.



Photograph by C. D. Morris

A SECTION OF THE TREKKING TRAIN OF 5,000 CHRISTIANS WHO MADE THEIR TRAGIC WAY FROM KHARPUT TO THE SEA

Although Kharput, in central Asia Minor, is only 160 miles by air line from Trebizond, on the Black Sea, these unhappy refugees were forced to pursue a circuitous route which stretched to 500 miles (see text, page 557).



Photograph by C. D. Morris

DYNAMITING THE WALLS OF BUILDINGS ALONG THE QUAY DURING THE SMYRNA FIRE

the multitude's outermost ranks, hurled back by its scorched inner ranks, toppled over the jetty's verge and into the sea.

Beside this nightmare of 300,000 souls crushed together on Smyrna's quay, with no escape through the encircling ring of sea and fire, tales of burning Ilium faded into futility.

When with dawn the Disaster Relief Committee's workers headed their motor cars toward the quay, at times dismounting to clear corpses from the streets leading thither, two-thirds of Smyrna lay blackened and smoldering, an outstretched chaos. From the announcement board of a charred cinema theater, standing stark amid desolated acres, glared like a red-lettered epitaph "The Dance of Death!"

High on Pagos' crests rose the unscathed Turkish quarters' minarets like symbols of victory.

DESTITUTE THOUSANDS LIVE IN CELLARS AND ON THE QUAY

When, three days later, the conflagration had exhausted itself, 100,000 people withdrew from the quay to the cellars, these thronged "*abris*" recalling wartime Paris under air raid, while outside went on bombardmentlike explosions, with smoke clouds ballooning skyward over the dynamited buildings (see page 538).

For another week the remaining 200,000 continued to live, and die, and bring other beings to birth on that unforgettable quay. With Smyrna's bakeries burned, or idle because of water shortage, they gorged on raw flesh, torn from animals' carcasses, or on the sea biscuit that the American sailors brought ashore in tins.

Burned, too, were all hospitals and their occupants; so within that multitude—so densely packed that one could not lie down without being crushed to death—women gave birth to stillborn babies and sheltered them against their dried-up breasts, for lack of a burial place, until some fresh stampede—perhaps over the arrival of a bucket of water—opened a momentary pathway for them to lay their burdens in the all-receiving sea.

By now the emerald-clear waters showed a bottom strewn with the drowned, and gangs of body fishers were coolly plying hooked lengths of telegraph wire for the

loot of finger-rings and turned-out pockets (see illustration, page 565).

How to escape from a harbor where lay only neutral warships? Yet nightly these vessels lent at least their searchlights' protection; for, from wherever the quay lay black, there wafted seaward a great multitudinous cry, telling of the presence of night gangs among their victims; then, with the searchlights' blinding swerve upon the spot, the moaning would die away.

Only once a civilian craft appeared, and from it stepped red-fezzed officials, who cut twelve rams' throats and knelt by the streaming blood to thank Allah for their nation's victory.

DISASTER COMMITTEE SAVES 60,000 FAMILIES FROM DEPORTATION

Because of a lack of ships to bear them away, 60,000 refugee families, of all classes, from peasants to bankers, were to be "deported," as the dreaded phrase ran, "into the interior."

It was now that the Disaster Committee, whose workers had not removed their clothes for a week, performed a unique service. With the Turks' formal assurances that Greek vessels not flying their national flag or docking at the quay would be exempt from seizure, one of the Committee sped by destroyer to Athens, where, upon written guarantees embodying these assurances, he rounded up a squadron of rescue ships and returned with them to Smyrna.

Meanwhile the Turkish command had notified the Allies of its permission for the removal of all refugees except males from 17 to 45 years (see page 562).

Almost simultaneously revolution burst over Greece. On Mitylene and Chios 75,000 defeated and disaffected troops commandeered warships and merchantmen, then embarked for Athens, displaying mock effigies of royalty and singing republican songs. In the capital the joyous scenes of three years before had been replaced by the spectacle of stunned multitudes upon whom airplanes were showering manifestoes that urged national salvation by revolution.

Over Smyrna's refugees on the eve of the evacuation another manifesto-dropping airplane, a Turkish one, was circling.

The handbills informed this homeless and now governmentless multitude that those not out of the city within a week's time would be deported. This resulted next morning in the mad stampede of 350,000 people toward the quay-traversing barrier that led to several other such barriers on the railroad pier. Anchored in the harbor lay the long-awaited ships—how hopelessly small and few they seemed!—Greek ships flying the American flag.

Uncounted hundreds were crushed to death or pushed over the quayside to drown, on that first day, when eight ships, convoyed by American destroyers, departed with 43,000 souls aboard. For those left behind there remained but six more chances—a chance a day—then the black despair of deportation into the interior (see pages 558 and 562).

Six more days at the barriers, where women's shrieks told of wives being pushed through to liberty and of husbands dragged back for the rope-gang, consisting of male deportees in file between two long wrist-binding ropes; where women so bereft and men so detained went mad and leaped into the sea; where all were searched and the despoiled wealthy were turned back at the final barrier, so that they might reappear to-morrow with a fresh supply of money; where the sudden sighting of a rescue ship brought death by crushing or drowning; where the night patrol sighted secret swimmers—deportable men—passing through the pathway of a destroyer's searchlight, which, while the pursuing shots rang out, suddenly veered elsewhere at some humane commander's order of "Switch it and give the poor devils a chance!"

With the Turks' house-to-house search, 100,000 cellar-hiders were added to the diminishing quay population, this necessitating a time-extension of six days.

THE FLIGHT OF THOUSANDS FROM THRACE

By October 8 the evacuation was complete. Disregarding the great number of deported men and youths, 300,000 people had been evacuated in a fortnight, 180,000 of them under the supervision of the United States Navy and the Disaster Relief Committee, assisted by British naval forces. Estimates of the Smyrna disaster placed the loss of life at 10,000 and

the property destruction at \$300,000,000. And thus this second wave in the great trek passed over into Greece.

By now, addresses before the League of Nations were urging that body to act in the crisis. But though 400,000 refugees were scattered at Athens, Saloniki, Rodosto, and the Ægean islands in lots of 50,000 to 100,000, the crisis was not yet. On September 23 an Allied note had retransferred to the victorious Turks East Thrace, which had been annexed by Greece under the Sèvres Treaty. This triangular "backyard of Constantinople" stretched westward from 25 miles behind the city to the Maritza River and contained 600,000 Greek and Turkish farmers, in about equal racial proportions.

Bulletins giving a month's notice of the withdrawal of the Greek troops and the entrance of Turkish gendarmerie were to be posted in order to allay possible panic. But panic was already abroad, as inextinguishable as Smyrna's. Within one week of the quayside evacuation, Thracian Greeks saw Greek troops striking camp and marching westward.

"You're coming back?" the farmers anxiously asked.

"No," was the response.

And within an hour villages were deserted. Household goods and sacks of seed grain were flung into wains, the oxen were hitched, then the little community trekked westward, out of the backyard of Constantinople.

Village by village the sight of the departing soldiers surprised women grinding at handmills, men on the threshing sledges, always with the same instant result—the dropping of tools, the crowding into hastily loaded farm wagons, the departure westward.

Many a local official ran out, protesting: "Turn back! Get your harvest! You've a month yet."

Always the same, dull, fate-ridden response: "No. All is lost. We must move into Old Greece."

Everywhere throughout the plain the word passed, the trek began, the endless caravan lines took form.

Ahead the sky grew dark. Rain fell in torrents, washing out roads and swampy fields, as this Christian hegira into Greece moved slowly, multitudinously on.



THEY MUST BEGIN SCHOOL ALL OVER AGAIN

The tens of thousands of Moslem children, transferred under the Exchange of Populations from Greece, spoke only Greek, though their forefathers spoke only Turkish. Hence, upon landing in Asia Minor they will have to learn a new language.



Autochromes Lumière by Gervais Courtellemont

THE FIRST-BORN IN HIS CRADLE

The first-born son shall, says the Koran, "have the preëminence above women because of all the advantages wherein God has caused the one to excel the other," and therefore he "shall claim a double share of any inheritance." Meanwhile, according to custom, he is lying packed in pulverized sand, and swaddled, and if he cries he will be given a piece of Turkish sweet wrapped in a rag.



THE FORT OF RUMELI HISSAR ON THE EUROPEAN SIDE OF THE BOSPORUS

This castle, built by Mohammed II in 1452, preliminary to the siege of Constantinople, commands the narrowest part of the Bosphorus, only about 800 yards wide. The swift current of the strait is here known as Sheitan Akindisi (Satan's Stream).



©

Autochromes Lumière by Gervais Courtellemont

IN THE GOLDEN HORN, PORT OF STAMBOUL

Mohammed II brought his fleet to this harbor overland from Rumeli Hissar by means of greased planks, after the Greeks had blocked its entrance with chains. The caïques, in the foreground, are the gondolas of Constantinople and are used in transporting passengers between ships and quays. The tall masts of fishing smacks are seen in the background.



THE SWEET WATERS OF ASIA

Near by rise the towers of Anatoli Hissar (Anatolian Castle) built by Mohammed the Conqueror's great-grandfather, Bayezid I, immediately opposite Rumeli Hissar (see opposite page). A Moslem poet describes the Sweet Waters of Asia as surpassing all other beauty spots in Asia.



©

Autochromes Lumière by Gervais Courtellemont
IN STAMBOUL'S RESIDENTIAL QUARTER

By night the *bekji* (watchman) on his rounds bangs his baton on these cobbles every few hours, to wake you up and inform you that all's well. Or perhaps he shouts a warning as to where a fire may be, for these wooden houses of Stamboul burn like tinder, and several thousand may be destroyed in a few hours.



©

THE HOUR OF REST

Not far from this ancient city of Brusa is Kutaia, home of beautiful glazed pottery and tiles. The entire dome of the Yeshil Turbeh (Green Tomb) at Brusa is covered with tiles of exactly the shade shown here—the color associated with the Prophet and with holy men generally. The medallion set in the tile is a sort of monogram of interlaced Arabic letters meaning “The Possessor of the World” (God).



Autochromes Lumière by Gervais Courtellemont

A STREET SCENE IN BRUSA

Here, as in less sanitary municipalities of Asia Minor, the cobbles slant toward the middle of the street, so that the drainage can collect and be flushed away with the first heavy rain. Brusa is one of the few important towns of Anatolia whose winding thoroughfares are lighted at night, the illumination being provided by lanterns hung outside each householder's door.



©

MOSQUES AND MINARETS OF BRUSA
Autochromes Lumière by Gervais Courtellement

There is a saying in the Near East that this historic city of Asia Minor has a mosque and a walk for every day in the year. In the background rises the Asian Olympus, called by the Turks, Keshish Dag.



Autochromes Lumière by Gervais Courtellement

THREE LITTLE MAIDS FROM ISLAMLAND

Not yet old enough to be concerned with the necessity for veiling their faces from the photographer, they nevertheless have covered their hair as a symbol of modesty.



GALATA QUAY, OPPOSITE SERAGLIO POINT: CONSTANTINOPLE

The grower of these onions is assessed the *ushr*, or tenth of his crop, either in cash or in kind, as a government tax. These vegetables, as well as beets, saffron, pomegranate rinds, and walnut leaves are used for dyes for rug wool. Since the Exchange of Populations began, the commerce of Constantinople has declined woefully.



©

Autochromes Lumière by Gervais Courtellemont

THE TOMB OF MURAD II AT BRUSA

Because the Moslem monarch expressed the wish that his grave be exposed to the elements, like that of any common man, there is a hole in the dome, through which the rain falls. Many of Turkey's early sultans are buried in this city.

SUN-PAINTED SCENES IN THE NEAR EAST



CYPRESS-SENTINELED BRUSA

For centuries before the Turks began their westward drive across Asia Minor, Greeks had settled here and had given the name of their Home of the Gods to the mountain which towers behind the city. Tradition says that Brusa was founded at the suggestion of Hannibal and was for a long time the seat of the Bithynian kings.



Autochromes Lumière by Gervais Courtellemont

A SHOP IN KONIA

The Turks are expert workers in leather and are especially partial to red-topped boots, like those shown here. The shopkeeper has brought his customer a cup of coffee to be sipped while a bargain is being struck and the footwear is being tried on.



THE INNER COURTYARD OF A TURKISH HOME

The inscription over the doorway is a motto taken from the writings of Saadi, the famous Persian poet: "Do not rely on the wealth of the world, as it has elevated many like thee only to destroy them."



©

Autochromes Lumière by Gervais Courtellemont
GIVING HER HOUSEHOLD INSTRUCTIONS FOR THE DAY

The mistress (*hanum*) of this Turkish home is seated on a divan in the courtyard of her house (see above). In the harem of a well-to-do Turk the hanum usually is surrounded by numerous slaves.



A CHILD OF DAMASCUS

A Moslem girl is not required to assume the *yashmak* (veil) until she is twelve or fourteen years of age. It is fast losing all significance in the Near East except as a national headdress, although the Nationalists have announced that the custom would be restored.



©

Autochromes Lumière by Gervais Courtellemont
MELONS AND PUMPKINS FOR SALE

The genial old merchants are wearing the long *aba*, familiar throughout Persia, Syria and Asia Minor and called by the Christians of Kaisariye "the coat without a seam." The big whisks are used first for sprinkling the dirt floor with water, then for sweeping it.



© **RESTING ON THE WAY FROM THE FOUNTAIN**
Antochromes Lumière by Gervais Courtellemont

The Koran's words, "By water everything lives" are commonly inscribed on Moslem public fountains. Near Eastern water-jars are unglazed and porous, the evaporation keeping the water cool. Fresh water supply was one of the great problems aboard closely packed ships during the Exchange.



THE COFFEE BEARER

With water, Arabian coffee and sugar as the ingredients "1-1-1" are the proportions (one of sugar and one of pulverized coffee to one demi-tasse). This, with sweetenings, is offered as the invariable hospitality to guests in Near East homes.



©

Autochromes Lumière by Gervais Courtellemont

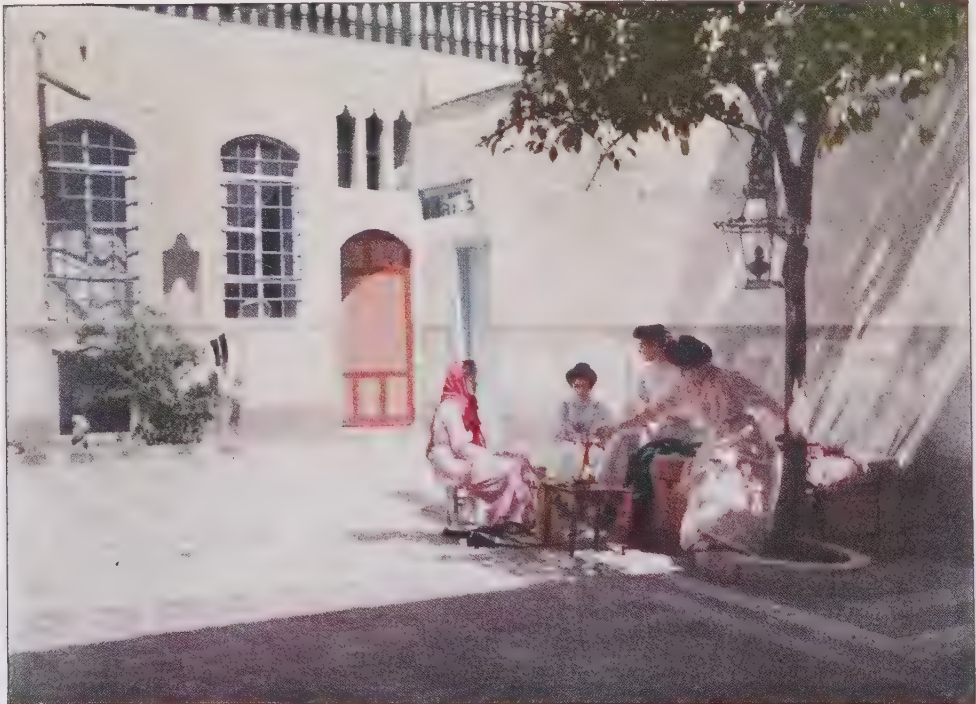
SYRIAN FRUIT VENDERS DISPLAYING GRAPES OF DAMASCUS AND MELONS OF HAMA



Both Anatolia and Syria are fruit countries. Much fruit is dried, but canning and preserving industries are practically unknown. The young melon merchants at the railway stations in hot Syria are always well patronized. The boiled-down syrup of the grape, which in this part of the world is regarded as the king of fruits, makes *pekmez*, which is used like apple butter.



THE COURT OF A MOSQUE OF A TEKKEH, OR MONASTERY FOR DERVISHES



©

Autochromes Lumière by Gervais Courtellemont
IN THE COURTYARD OF A SYRIAN HOME

The women of this wealthy household find the courtyard refreshingly cool during the day, and frequently repair to it in the evening also, as indicated by the lantern suspended from the branches of the lemon tree.

SUN-PAINTED SCENES IN THE NEAR EAST



A SWEETMEAT PARTY ON THE ROOF OF A MUSSULMAN HOME



©

Autochromes Lumière by Gervais Courtellemont

READY FOR A DESERT JOURNEY

The ass is always the pacemaker for the camel, who is the freight car of the desert. This photograph was made near Damascus, on the caravan route to Hit, on the Euphrates, 70 miles northwest of Bagdad.



©

CHRISTIAN WOMEN OF PALESTINE WHO WERE FORMERLY TURKISH SUBJECTS

With the surrender of Syria to French mandate and of Palestine to British mandate, many Christian peoples were relieved of allegiance to a Moslem power. Note the large antique veils in the illustration at the left. These women are all Nazarenes, and their village is Bethlehem, birthplace of Jesus.



Autochromes Lumière by Gervais Courtellemont



©

A YOUNG WOMAN OF BETHLEHEM

Autochrones Lumière by Gervais Courtellemont



AN ARABIAN EMIR OF DAMASCUS



OLIVE DEALERS OF DAMASCUS

Olives are the butter of the poor in the Near East. The green fruit is seldom seen, the natives preferring it ripe and full of oil. If a Turk or a Greek goes on a long journey, as in the case of the Exchange of Populations, he provides himself with a huge disk of bread, a bag of olives, and a few dried fish.



©

Autochromes Lumière by Gervais Courtellemont
CHRISTIAN WOMEN OF DAMASCUS

At Rodosto 28,000 trekkers descended the cliffs to camp on the wind-swept beach, waiting there for rescue ships until they were on starvation's verge—this while in the deserted interior their harvest mildewed where it lay (see page 577).

Through Adrianople 60,000 poured during the first six days. So fast had action followed upon rumor that those trekking from nearest Constantinople saw throughout the entire line of march only moving caravans and deserted villages where, a few weeks later, starved cats and dogs were devouring each others' carcases.

Men and women, trudging ahead to lighten the fast-miring wagons, bore shotguns; for thousands of the *comitadji*—those stormy petrels of the Balkans—were ambushing and raiding the emigrants. Many a wain entered Dedeagatch or Adrianople with the wife leading the oxen and her man's body stretched across the grain sacks.

"AN EPIC OF RAIN"

By day and night, but always through that equinoctial downpour, the self-exiled host, which had mounted to 180,000 in twelve days, plodded on toward the marshlands of the ever-rising Maritza. For a few hours the oxen would be outspanned and families would snatch sleep, lying for warmth against the steaming stomachs of their cattle, while with a shriek and a blaze of lights the luxurious Oriental Express would thunder by. Then the trek, or rather tortoiselike race of mud-caked carts and weary oxen to gain the river before it became impassable, would go drearily, doggedly on.

From the Maritza's banks, where incoming roads converge upon the Karagach bridge, or from the river-commanding rooftops of Adrianople, one could watch the last lap of the flight: by day the desolate prairie, over which, from foreground to skyline, wound the endless, snakelike procession, gray under slanting rain; by night the swaying streak of lanterns across black infinitude, up from which arose confusedly the lowing of cattle, the sharp whip-cracks, the dull rain-drench, the thousandfold scream of wooden wheels rasping on wooden axles.

Watchers who had said of Smyrna's

awful pyrotechnics, "It is an epic of fire!" said of East Thrace's multitudes, bowed under the lashing downpour, as if it were the whips of the Fates, "It is an epic of rain."

And thus 300,000 crossed the swollen Maritza and strewed its western banks; and thus the third wave in the great trek, now mounting to 700,000, passed across the frontiers of Greece (see page 586).

GREEKS FLEE FROM CONSTANTINOPLE

Already another, a mere wavelet of 25,000, had gathered head in Constantinople and along the Dardanelles while the Nationalists' army was wheeling northward from the conquest of Smyrna. Arriving at the capital amid a greeting of green war flags and rams' blood, their Commissioner Extraordinary, after several conferences with the Allied chiefs, had announced, "And, by the way, since noon the city government, in our view, no longer exists. Accordingly I have assumed control."

That night Stamboul's minarets were festally illuminated, while past Pera's foreign embassies thronged Turkish-student crowds, shouting, "Down with the monarchy! Long live new Turkey!" And thereafter whoso among the Greeks could conveniently depart from the capital did so.

When Friday came, with its historic *se-lamlık*—the Sultan's progress to prayer—the waiting crowds were turned away, for overnight Mohammed VI had fled to Malta. And, finally, a Nationalist occupying force entered the city, crossed Galata bridge over flower-strewn cobbles agush with rams' blood, and ascended Galata hill among a sea of red fezzes, while sirens shrilled to Europe and Asia the news that the Turks were back in Constantinople.

Hardly had these events taken place when a Nationalist edict, posted throughout Asia Minor, announced "permission" for all non-Moslems to leave the country before November 30. Upon this notification the remaining Christian population of inner Anatolia arose *en masse* and fled for the Black Sea coast.

Almost immediately 40,000 women, children, and infirm—their men being held as prisoners of war—swamped the



BOAT LOADED WITH REFUGEES LEAVING THE RAILROAD PIER AT SMYRNA

British sailors, in white uniforms, assisted and directed the embarkation; American sailors worked farther back, on land, and at the entrance to the pier.



Photographs by C. D. Morris

AT THE LAST BARRICADE: SMYRNA

The Railroad Pier juts out a quarter mile into the Smyrna harbor, with several lines of track running its entire length. All persons wishing to leave Smyrna were herded on land at the base of the pier, and then passed through a series of four barricades, where Turkish soldiers weeded out those who were not allowed to go (see text, page 540). At each barricade those taken out were grouped as prisoners, at one side, until they could be removed. Here the prisoners are seen at the left, guarded by Turkish soldiers. There is a line of women and children with bundles at the right, passing on to the ships. Those allowed to go to the ships have been four times searched and have four times presented their credentials. A British sailor stands by the telegraph pole in the foreground. An American sailor stands atop the barricade at the gate.



Photograph by C. D. Morris

AMERICAN SAILORS MOVING REFUGEES ON A HAND TRUCK: SMYRNA

seaport of Samsun, and within three weeks 250,000 more were tramping the snowy roads toward Trebizond, Sinope, and Ineboli (see page 537).

"Permission" had been construed as "expulsion," and from as far as 500 miles inland villagers and townsfolk assembled, their backs piled with bedding and cradles, turning for a last glimpse of roof and vineyard, as they set out across the wintry plain.

With ship-deserted quays, as at Smyrna, and with the Black Sea ports glutted with sidewalk-sleeping, disease-breeding paupers, who had been thrifty cottagers a few weeks before, the gap was finally bridged by the arrival of Greek ships flying the Stars and Stripes and convoyed by American destroyers.

By January, 1923, some 80,000 refugees, or about one-tenth of this, the fourth and most formidable wave in the great trek, had reached Greece, where the never-ending influx at last became so insupportable that Athens slammed her official doors, protesting against "further expulsions."

The alternative proved to be disused barracks and barrack stables near Con-

stantinople as the dumping ground for 100,000 Anatolian Greeks, where they died at the rate of 300 a day.

A GLIMPSE AT LIFE IN THE REFUGEE CAMP

Could any eyewitness portray, far less any reader imagine, the miracle of mute heroism, self-respect, and cheer that kenneled in those yellow Selimiyeh barracks? (see, also, pages 570, 573, and 587).

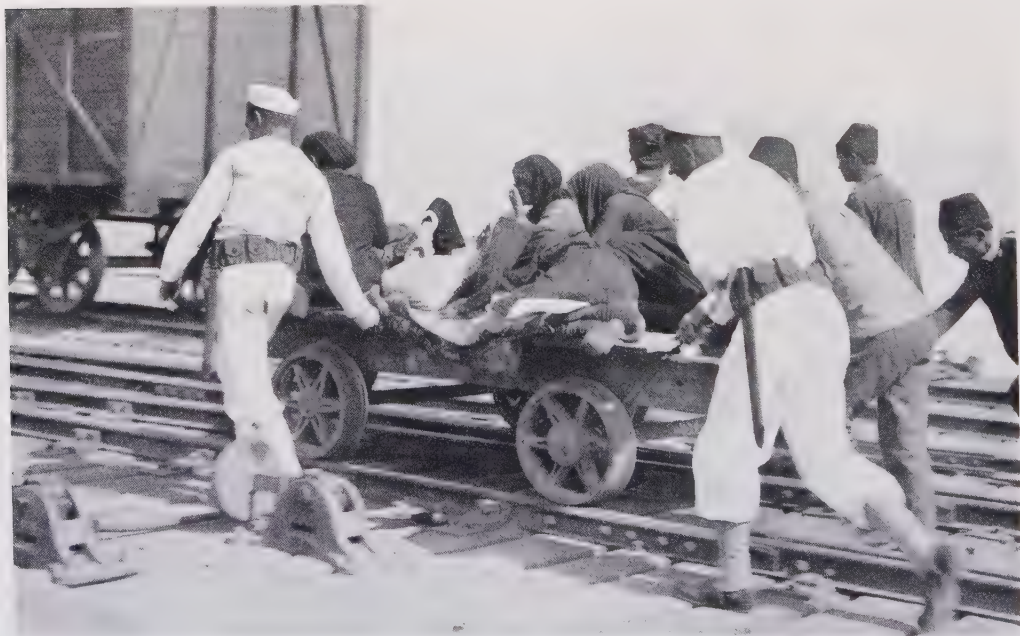
This vast, gloomy space within four walls, once whitewashed, but now grimy as the earthen floor itself—can it serve this inpouring, heavily laden multitude of women, children, and old folks as anything more than a morgue? Yet immediately they pile up their boxes and sacks and stretch burlap curtains, thus creating waist-high party-walls, each tiny partition containing a family. The morgue has become at least a kind of cattle-pen.

In each family the mother builds a fireplace out of a few stones; the children heap it with bits of firewood. Soon the copper saucepan bubbles with its few handfuls of maize; the family rug is spread with all the ceremony of laying a communion cloth. The black-eyed baby scrambles about, gurgling. The wrinkled



BRITISH AND AMERICAN SAILORS WORKING SIDE BY SIDE DOING STRETCHER WORK
AT SMYRNA

The topee-shaped hat of the Britisher distinguishes him from his American fellow worker with round white cap.



Photographs by C. D. Morris

AMERICAN SAILORS TAKING REFUGEES TO A RELIEF BOAT ON A HAND CAR

This car is running on rails down Railroad Pier (see, also, illustration, page 558). It took ten hours for the refugees to pass the pier barricades, at each of which they were examined, the men of military age being manacled and deported into the interior to make roads.



Photograph by C. D. Morris

BOATS CARRYING REFUGEES FROM THE BURNING ZONE OF SMYRNA TO A RELIEF SHIP
IN THE HARBOR (SEE TEXT, PAGE 540)

grandmother hangs an image of the crucified Christ on a burlap curtain. The cattle-pen has become a home.

They may live or die, according to the typhus' lightninglike preferences; yet while they live you will find among them no mendicant whinings or supplicative palms. The children will forage for wood and for the herbs and roots which compose refugee fodder; the mother will keep the dirt floor sprinkled and do the family washing; the grandmother will lift aside the burlap cradle curtain to show you little Giorgios asleep, and with a patient smile will explain, if you ask, the mystery of how refugees exist. It is, simply, "We all help one another."

And, meanwhile, behind Greece's officially closed doors? A small country of no great natural wealth, she had just emerged from 10 years of continuous mobilization and intermittent wars, culminating in a recent defeat, only to be plunged into refugeeism on a colossal

scale. Without reference to the total results of the Exchange, Greece had received within a year of the fall of Smyrna 1,250,000 exiles. This 25 per cent leap in her population meant that to every four citizens throughout the land one homeless and usually destitute person had been added.

NO PARALLEL FOR GREECE'S PLIGHT

And what of the land itself? In Old Greece, as of 1912, more than three-fifths of the total area was uncultivated and useless. While, largely as a result of the Balkan Wars, her territory has expanded to 53,000 square miles, only one-fifth of this was under cultivation or pasture in 1923.

Because of mountains or swampy land, by far the major portion of Greece lay unredeemable or as yet unredeemed when the inrush of exiles began. She must still depend largely upon other countries for grain, and her total cereal production



WEEDING OUT MEN FOR DEPORTATION: SMYRNA



Photographs by C. D. Morris

TURNED BACK

After the fire these unfortunates, being between the age limits of 17 and 45 years, were not permitted to leave Smyrna with their families, but were sent back to the interior of Anatolia (see text, pages 539 and 540).



Photograph by Lex W. Kluttz

GREEK REFUGEES FROM ASIA MINOR ARRIVING IN MITYLENE

The fertile island of Mitylene (Lesbos), the second largest in the Ægean Sea, possesses in the Gulfs of Hiero and Kaloni two of the finest harbors in the world.

for 1923 was scarcely more than one-half the amount needed.

There is no adequate parallel whereby to convey even remotely a picture of Greece's plight in 1923. One may imagine Arkansas or North Carolina, each having about the same area as Greece, as being suddenly swamped by a million and a quarter immigrants; or one may imagine the United States as being overrun by 26,000,000 destitute foreigners. In the latter instance, supposing that they arrived at the highest annual rate in our immigration history, this would take twenty years. But if, as in Greece's case, they arrived within one year—if in New York, Chicago, and San Francisco each two citizens were forced by law to shelter one refugee—the crisis of a 25 per cent increase would become apparent.

By now Athens and Saloniki were surrounded by tented plains and resembled classic engravings of besieged cities. And the besieging hosts were those of Hunger. Daily from out these canvas-covered slums, over which the Acropolis showed golden against a turquoise sky, came

women to sell their trinkets, rugs, sewing machines, until all they had brought out of Asia Minor had gone for handfuls of coarse grain and they had become recruits in the national dole-line of 800,000 people.

TYPHUS AND SMALLPOX THIN THE RANKS OF THE DESTITUTE

Then Nature's terrible correctives appeared. Instead of a birth rate, which had dropped to zero, typhus at 36 centers and smallpox at 60 centers throughout the country's 800 refugee localities yielded by January, 1923, a death rate of 1,000 daily.

To avert the horrors of a plague-swept Greece, a quarantine station for incoming refugee ships was established off the coast at Makronisi Island (see page 576) by an American organization, while other American agencies were in the field with food relief, medical assistance, and orphanage work. For by now the world had been stirred by this cataclysm of peoples, and seven American and five European organizations were coöperating variously with the Greek Government.

The Greek Government itself, up to



Photograph by C. D. Morris

ARRIVAL OF AMERICAN FLOUR AT THE QUAY IN SMYRNA TO SUCCOR THE DISTRESSED
POPULATION OF THE BURNED AND FAMISHING CITY

November, 1923, when the League of Nations assumed the problem, had semiestablished 72,000 families in Macedonia, providing them with draft animals and seed grain. Meanwhile the remaining three-quarters of Greece's mushroomlike increase continued to carry on, as somehow refugees mysteriously can, by helping one another.

From being parked in tents, schools, churches, and theaters, the exiles actually advanced in some cases to constructing suburbs for themselves. At Athens, upon learning that some near-by mud flats could be squatted upon, 3,000 women, children, and old folks emerged from their parking corners in and about the Theseion and other classical ruins and swarmed off to build themselves a village (see page 572).

Now, every Anatolian born knows the use of clay, and here was plenty of it. The old folks gathered chaff, the women mixed it with the clay and cut this into bricks, the children played hod-carrier, the walls were erected on the refugee principle of helping one another, and the baking sun did the rest (see page 583).

Soon miniature shops were selling nuts

and dried figs, cobblers were working at rough benches, and girls were knotting and clipping at rug-frames. In a few short months this trek from classic temples to mud tenements was accomplished, while from afar there gazed down upon this squalid hut settlement the imperishable lineaments of the Parthenon.

ORDERLY EXCHANGE WELCOMED BY BOTH
COUNTRIES

And now Lausanne came to the relief with a document, signed on January 30, 1923, entitled, "A Convention concerning the exchange of Greek and Turkish populations." It had come about by Greece's insistence that Turkey must accept the 450,000 Moslems resident in the Hellenic Kingdom in order to make room for the former's million or more refugees.

Further argument stressed the point that the hardships attendant upon such an exchange would be far less than would result in the way of postwar bitterness against the respective minorities if nothing were done.

Greece welcomed the Exchange as an economic necessity.



Photograph by C. D. Morris

GHOULS FISHING FOR BODIES AFTER THE SMYRNA DISASTER (SEE TEXT, PAGE 539)

Due to panic and enormous pressure, many people on the quay were either pushed overboard or committed suicide. Hundreds of corpses could be seen through the remarkably clear water of Smyrna Gulf, and youthful Turks fished them up with pieces of wire, for the purpose of loot.



© E. J. Hardcastle

RUINED SMYRNA: A PHOTOGRAPH TAKEN ONE YEAR AFTER THE DISASTER

Under the Turkish occupation of Smyrna no cameras were permitted to be carried ashore; hence the photographer made the snapshot from shipboard.



Photograph by C. D. Morris

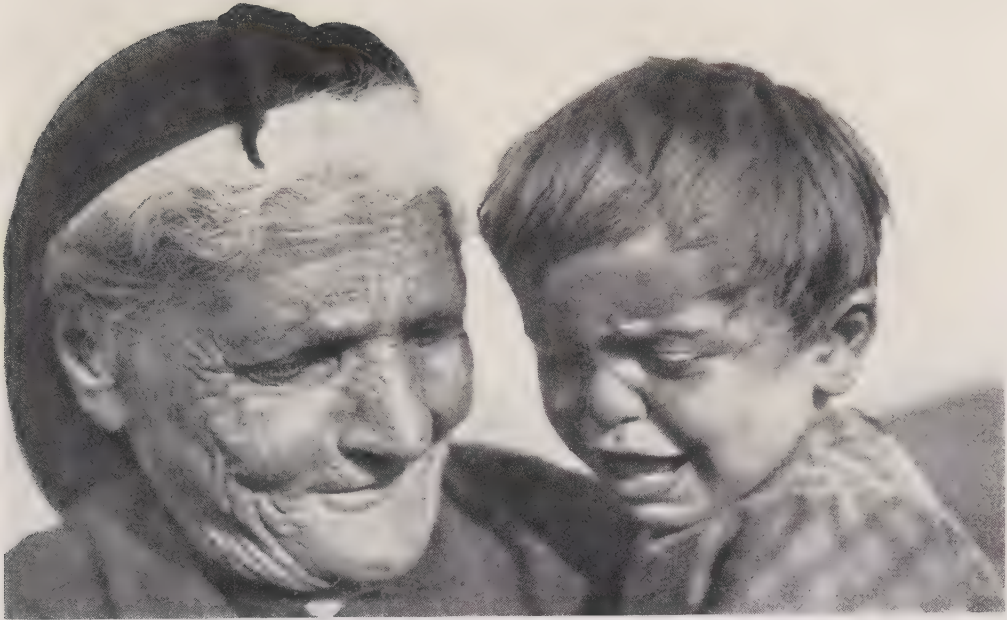
THE TYPE OF FIRE-FIGHTING EQUIPMENT WHICH WAS CALLED UPON TO COPE WITH
THE SMYRNA CONFLAGRATION

This is the kind of outfit which may be seen in Constantinople to-day.



Photograph by Lex W. Kluttz

REFUGEES ARRIVING AT PIRÆUS, PORT OF ATHENS, FROM SMYRNA



Photograph by C. D. Morris

A GREEK GRANDMOTHER AND BABY

A familiar sight among the transferred peoples was that of the old grandmother looking after the babies, the parents having died either in the Smyrna fire or from hardships connected with the long trip through Asia Minor.

Turkey also welcomed the Exchange as an economic necessity, though in quite a different sense. For two and a half centuries her Crescent had been diminishing toward eclipse. During the last hundred years she had relinquished rule over the peoples of twenty wide-flung territories. Within the last thirty years her area had shrunk from 1,500,000 to less than 350,000 square miles, and her population from 38,750,000 to 5,000,000. Yet she favored, and had in great part enforced, the complete withdrawal of non-Moslems from Asia Minor. Why was this?

It meant that the old régime, whereby foreign races had lived within her borders under religious toleration, accumulating much of the wealth, yet never becoming part of the social organism, had failed. So Turkey would clean house. She would apply the radical remedy of eliminating several millions, representing her wealth and commerce, and would build up from her own people corresponding elements wherewith to form a Turkish middle class

as the center of a homogeneous Turkish nation.

In this sense the Exchange was for her, as for Greece, an economic necessity. Here is an historical milestone on Turkey-in-Europe's long road of 1453-1923.

No less is the Exchange Convention an international milestone. It has its predecessors in population exchanges between the Turks and Bulgars in 1913, and between the Bulgars and Greeks in 1919, but differs from these in being compulsory and, moreover, in being conducted under the auspices of the League of Nations. Its essential clauses provide:

As from May 1st, 1923, a compulsory exchange of Turkish nationals of the Greek Orthodox religion, with Greek nationals of the Moslem religion—this to be retroactively inclusive of all Greeks and Moslems who had already emigrated at any time since October, 1912.

Movable property in their homes, mosques, churches, schools, convents or hospitals to be taken away tax-free by the emigrants; their immovable and abandoned property to be inventoried, valued and liquidated by the Mixed Commis-



Photograph by Lex W. Kluttz

ARRIVAL OF REFUGEES AT SALONIKI AFTER THE SMYRNA FIRE

Four and a half months after the Smyrna holocaust there were 110,000 refugees in Saloniki, thus nearly doubling its population. There was a crisscross movement of refugees here, one group coming from western Thrace, the other from Anatolia (see page 587, and text, page 590).



Photograph by C. D. Morris

SAMSUN REFUGEES AT PATRAS, GREECE, STARTING FOR THE INTERIOR

Many of these Asia Minor refugees from the Black Sea port have found work among the currant vineyards and olive groves of the Peloponnesus, of which Patras, fourth city of Greece, is the chief seaport.



Photograph by G. L. Berry

REFUGEES FROM ASIA MINOR AND THRACE AT THE PORTALS OF THE OLD PALACE:
ATHENS

Those who were registered received here, prior to January 1, 1923, the government's daily dole of two drachmas (about three cents).

sion—this liquidation process to be retroactive in respect to the property of Greeks and Moslems who had already emigrated at any time since October, 1912.

The Mixed Commission to consist of two Turks, two Greeks, and three nationals of countries neutral in the World War, the three to be chosen by the League of Nations;

Each emigrant to receive, in principle, property equi-valuable to that relinquished; the total value of relinquished properties to form government debts as between Turkey and Greece; the creditor country—a final balance having been struck—to receive from the other a settlement in part cash, in part interest-bearing certificates;

No obstacles to be raised or adverse pressure exercised or taxes imposed in respect to the emigrant; exempted peoples to be free to emigrate if they so wish;

Exempted peoples to include (a) Greeks established at Constantinople prior to October 30th, 1918, and (b) the Moslem inhabitants of West Thrace.

The exemption clause, which renders the Exchange incomplete to the extent of 635,000 people, sprang out of the liquida-

tion difficulties which would be involved in the case of the Constantinople Greeks, whose abandoned properties would have amounted to many millions of dollars; hence the compromise permitting these and the West Thracian Moslems to remain undisturbed.

In practice, the temporary crisis which arose from differing constructions of the phrase "established at Constantinople" seems on the way of solution by the voluntary departure of large numbers of Greeks from the Turkish capital.

STROKE OF THE PEN EXILES 3,000,000
PEOPLE

It is safe to say that history does not contain a more extraordinary document. Never before in the world's long pageant of folk-wanderings have 2,000,000 people—and certainly no less than 3,000,000 if the retroactive clause is possible of complete application—been exiled and re-adopted by a stroke of the pen.



Photograph by Harry Drucker

A REFUGEE WOMAN AT HER MAKESHIFT DRESSING TABLE: ATHENS

Note the whitewashed "balustrade" and the scrubbing brush, which now does duty as a hairbrush.

Even if regarded as a voluntary trek instead of a compulsory exchange, the movement would be without parallel in the history of emigration. The Klondike gold-rush peaked to only 22,000 in the year 1900, while that in California drew no more than 370,000 thither in 12 years. Dealing with immigrant masses of about 1,500,000 each, the Irish movement took 7 years, the Polish movement 10 years, and the Jewish movement 10 years, to land that number of their respective nationals in the United States. The highest human tide that ever reached our shores in one year (1907) was less than the Greek-Turkish shift by 750,000 people.

One might perhaps add that history has never produced a document more difficult of execution. It was to lessen these difficulties that exchangeability was based on religion and not race.

Due to five centuries of Turkish domination in Greece, the complexities in determining an individual's racial status are often such as would make a census taker weep. Here, for example, is a little prob-

lem which the Red Queen would have relished putting to Alice:

If certain Moslems in the Province of Epirus were descended from Greek Epirotes; if they embraced Islam in the 17th century; if they speak Albanian, yet are politically sympathetic toward Greece except in Albanian-Turkish difficulties, when they invariably side with the Turks, then what's the answer?

We would not blame anyone who might reply, with Alicelike meekness, "I'm sure I don't know."

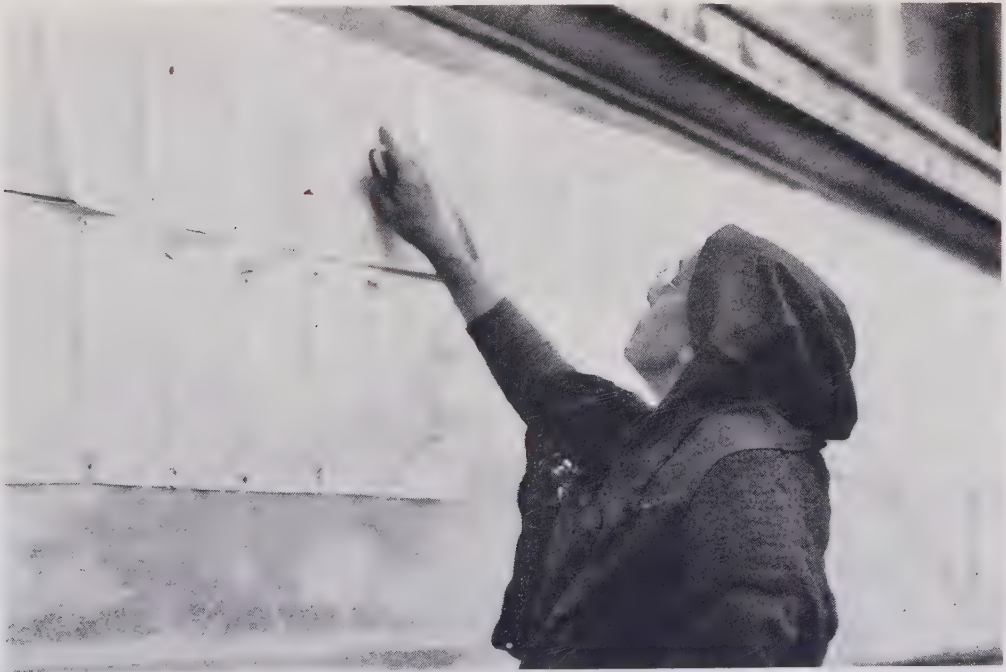
Of the machinery which was to handle these 2,000,000 people, one arm was the Mixed Commission, with 11 subcommissions presided over by 4 Danes, 3 Hollanders, 2 Swiss, 1 Norwegian, and 1 Swede; the Commission to sit at Constantinople, its subcommissions to function in Macedonia, West Thrace, Crete, and Asia Minor, in their work of handling 450,000 Moslems and the 150,000 Greeks still left in Anatolia.

The other arm, the Refugee Settlement Commission, with representatives at Saloniki and Athens, was charged with



CROWDS STUDYING THE BULLETIN BOARDS POSTED ON THE PALACE WALLS: ATHENS

Here distracted relatives sought for news of their loved ones, from whom they had been separated at the time of the debacle from Smyrna (see, also, illustration below).



Photographs by C. D. Morris

SEEKING THE NAMES OF HER LOST LOVED ONES: ATHENS

As a result of the destruction of Smyrna and the confusion of moving vast masses of people from Anatolia to Greece, a great number of families became separated. These bulletins, covering the lost and found, were posted daily at Athens.



Photograph by C. D. Morris

REFUGEES' TENTS IN THE FOREGROUND OF THE THESEION (SEE TEXT, PAGE 564): ATHENS

This magnificent temple, completed probably during the fifth century B. C., is the best-preserved edifice of the ancient Greek world.

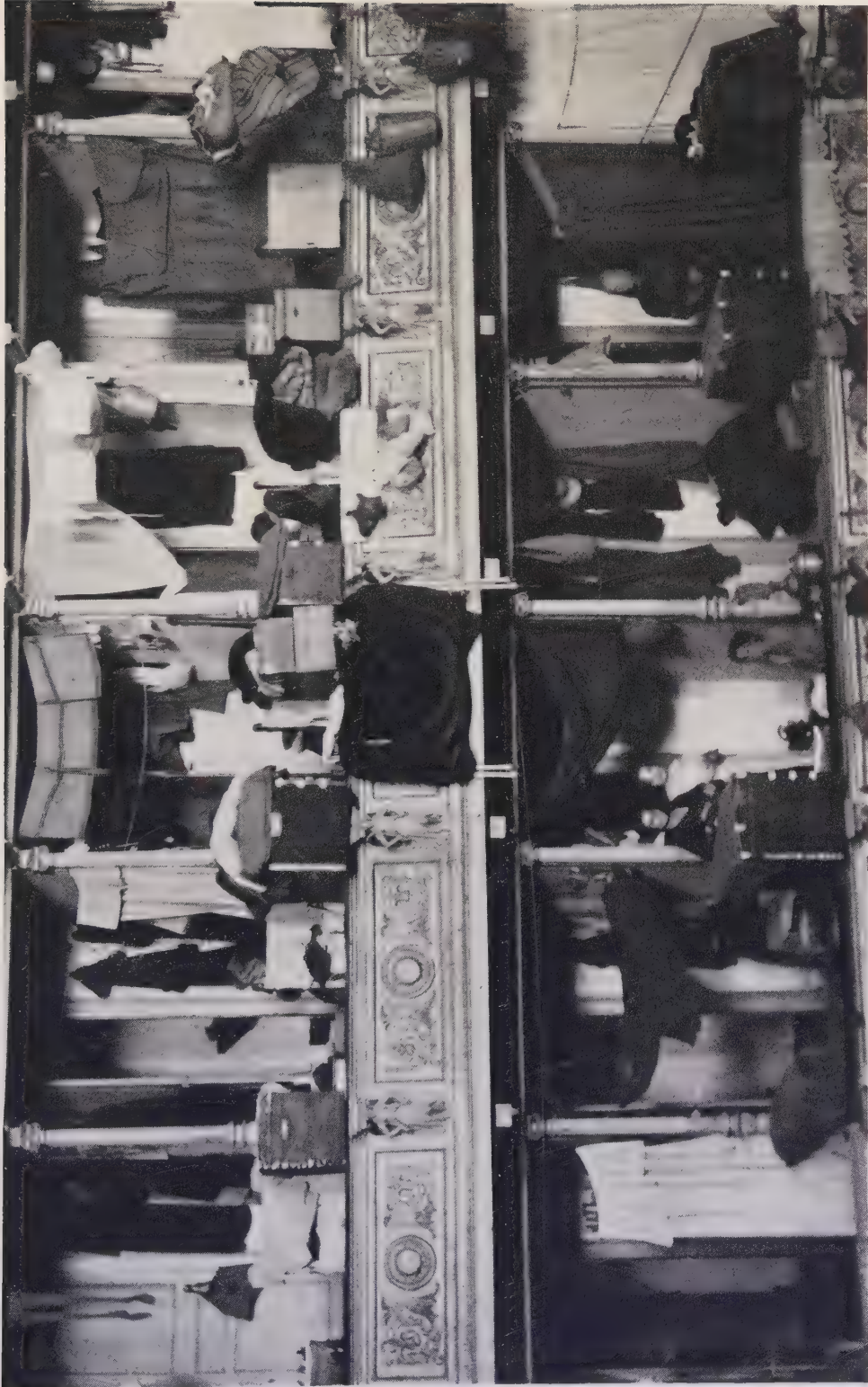
settling all Greek refugees, including the 150,000 yet to arrive, upon lands assigned by the Greek Government, or otherwise in productive occupation.

HARMONY PREVAILS DURING FIRST EXCHANGE

The Lausanne Treaty was not ratified until July, 1923. Two months later, with the official machinery not yet functioning and with a general cessation of agriculture pending the Exchange, both interested governments welcomed initiative action by Americans. During the week of October 15-21, under committees composed of Greek and Turkish officials, with field workers of the Near East Relief acting as neutral members, 8,000 Moslems were evacuated from Mitylene to Aivali, in Asia Minor, in exchange for the same number of Greeks, transported in Greek vessels from Samsun to Saloniki.

To everyone's surprise, this opening of the Exchange was effected with perfect harmony. The Moslem families, with their flocks and household goods, trekked to Mitylene's various ports, where small Turkish steamers were waiting. Taxes and passports were waived; minor offenders were released from prison; the women were even permitted to take with them their strings of gold coins (see Color Plate XV).

Believers in a traditional Hellenophobia-Turkophobia would have stared at the sight of the Mitylene Greeks spreading farewell meals for their departing



Photograph by Harry Drucker

THE GOLDEN HORSESHOE AT THE ROYAL OPERA HOUSE IN ATHENS AFTER THE SMYRNA DISASTER

The "box-holders" are refugees, who have set up housekeeping with all the goods and chattels which they could bring with them from the stricken metropolis of Asia Minor. Each box accommodates a family (see text, page 564).



Photograph by C. D. Morris

HER PLAYFELLOW IS ONE OF THE PALACE GUARDS IN ATHENS
This is one of the *Eyzones*, highland troops of Greece, accounted the bravest among her soldiers.

neighbors, and later accompanying them to the quay, where Christians and Mohammedans, who for a lifetime had been plowing adjacently and even sharing occasional backgammon games at village cafés, embraced and parted with tears. Then, seated on their heaped-up baggage, with their flocks around them—the women weeping, the children hugging their pets, the graybearded *babas* all dignity, as is their wont—the Mitylene Moslems set forth for unknown Turkey.

At Aivali, their "Ellis Island" of entry, interpreters speaking the familiar Greek and the unfamiliar Turkish installed them temporarily in waiting houses. Later

they were distributed throughout the country according to trades and subject to a Turkish regulation limiting any village's increase, under the Exchange, to one-fifth of the population. While the family unit was preserved, the Mitylene communities were dissolved forever.

MOSLEMS CAMP FOR TWO MONTHS AT SALONIKI

In November the Refugee Settlement Commission began its program in Greece. A month later the Mixed Commission's branches were preparing lists of exchangeable Moslems, filling out their declarations of property values, and supervising their transportation; for by agreement, in consequence of Greece's glut of refugees, evacuation of the Moslems was to precede by six months that of the Anatolian Greeks.

The principle of first-come-first-served did not advantage the initial rush of Macedonian Moslems for the seaboard. Surrounded by their household goods, they camped on Saloniki's bleak quay for two months while waiting for the Turkish exchange ships to arrive. There were no schedules, and delays of a mere month or so counted as nothing on these voyages into the unknown.

Not until Greece's shores had faded into a blue blur would the skipper open his sealed orders and announce the port of destination. It might be anywhere along 2,000 miles of Asian coast. Whether one liked that particular port or

not was of no consequence; and while one's passage was free, there were no return tickets on this voyage, which so aptly realized the poet's line, "What, without asking, whither hurried hence?"

Throughout a year Saloniki's long quay beheld the mournful pageant of departing Moslems. Had the shade of Mr. Gladstone been present to witness his fiat of half a century ago being realized, he must have softened at that picture of dignity in misfortune, the Turks going "out of Europe, bag and baggage."

Notwithstanding their new government's preparations to receive and care for them, many of the Moslems arriving in Asia Minor suffered even more than the exchanged Greeks. Some of the former found themselves in a war-devastated region, others in villages whose best houses had been preëmpted and whose poorer ones had been dismembered for firewood by those who had remained behind after the flight of the Greeks.

Unreckoned tens of thousands died by malaria or exposure, while multitudes of disillusioned families declined the second-hand pick of farms offered them and became wanderers. To the question, "Where are you bound for?" addressed to ox-drawn caravans roaming through the land, the answer would be, "We are looking for a tobacco field as good as ours at Drama," or, perhaps, "an olive grove like our old one on Mitylene."



Photograph by S. R. Vinton

A GREEK MOTHER AND HER BABY

Among the Macedonian refugees, hammocks were very commonly used instead of cribs.

By May 1, 1924, 250,000 Moslems had been evacuated; then the westbound flow of 150,000 Greeks set in, these moving simultaneously with the remaining 200,000 Moslems until, eight months later, the Exchange was complete.

LIFE MUST START AFRESH FOR 600,000

In this mechanized exiling of 600,000 souls the individual heartbreak was lost in the all-embracing swirl of things. Only here and there a glance, a gesture, a fragment of talk, revealed the undercurrents of this great Christian-Moslem drama.

Many a grayhaired shopkeeper beheld his lifelong customers dispersed, himself



THE AMERICAN QUARANTINE STATION ON MAKRONISI ISLAND, GREECE, FEEDING 6,000 GREEK REFUGEES FROM TREBIZOND, BLACK SEA PORT, WHO HAVE JUST ARRIVED BY STEAMER (SEE TEXT, PAGE 563)

Photograph by C. D. Morris

starting life afresh. And the old and honored public scribe—what use now his little writing box and literary flourishes, since his mother tongue would be as naught in yonder land of an alien speech?

Many a village Evangeline and her parted lover would vainly seek each other in Greece's mountain-barred valleys or in widespread Anatolia.

Here a child sobbed for a lost pet, and there a grandmother wept at the thought of some tiny hill-topping cemetery henceforth abandoned to weeds and forgetfulness.

And few were the congregations who listened dry-eyed to their pastor's last sermon, or who without deep emotion fell in line outside the door of their dismantled church to follow in the wake of priest and sacred emblems down to the waiting ships.

COMMISSION IS ADOPTED
FATHER OF 1,136,600
IMMIGRANTS

Striking a fresh balance sheet early in 1924 and including therein the exchanged Greeks still to come, the Refugee Settlement Commission found itself to be the officially adoptive father of 1,136,600 immigrants, of whom three-fifths were agriculturists. Against this tremendous debit the Commission held in Macedonia and West Thrace state-transferred lands totaling 1,250,000 acres, for colonization purposes and as loan guarantees.



Photograph by C. D. Morris

A WOMAN OF THE ENVIRONS OF CONSTANTINOPLE THRESHING GRAIN

When news spread of the withdrawal of Greek troops from the "backyard" of Constantinople (Thrace), Greek farmers were seized with panic and fled precipitately, leaving their ripening harvests ungathered in the fields (see text, page 540).



Photograph by Thomas Mills

THE GUARDED BREAD LINE, SOURCE OF SUPPLY IN CONSTANTINOPE



Photograph by S. R. Vinton

REFUGEES HOLDING UP TICKETS ENTITLING THEM TO PARTICIPATE IN THE
DISTRIBUTION OF OLD CLOTHES

A scene at the headquarters of one of the American relief organizations at Saloniki.



Photograph by C. D. Morris

A STREET SCENE IN A THRACIAN VILLAGE

According to a Moslem superstition, oxhorns bring good luck (see the upper right corner of the illustration).

These were pledged as against temporary financial advances until the Refugee Settlement Loan, subscribed at Athens, London, and New York, placed \$50,000,000 at the Commission's disposal.

If Hellas could call back her ancient gods and press them into service, Hercules of the Twelve Labors would certainly balk at the Commission's yet-unfinished task of integrating a million or more of Greece's distant kinsfolk into her economic fabric. Colonization had to start from the ground up, with surveying and motor plowing, for neither land maps nor boundaries existed in Macedonia, and the soil had been so long untilled that animal power was insufficient to break it. Whether it was a question of houses, plows, draft animals, or grain, the Commission, when supplying its gigantic fam-

ily, had to think in terms of hundreds of thousands. Often when houses were not forthcoming from abandoned Moslem properties, the colonists, as artisans on the Commission's payroll, erected their own dwellings out of stone, brick, or mud-plastered wattles, according to what the land offered (see page 583).

The undrained, mosquito-breeding marshes brought malaria, and the Gargantuan family had to be dosed with 15 tons of quinine. Drought came, and 50,000 cultivators must be rehabilitated with a \$1,000,000 worth of grain and forage. Any misfortune always struck wholesale—a thousandfold magnification of how measles will run through an entire household of children.

Meantime the Commission's civic work of settling the city dwellers, on the basis



Photograph by C. D. Morris

"BREAD! BREAD! BREAD!"

These are Greek civilian prisoners, released by the Turks after more than a year. During the war there had been taking of hostages on a large scale by both sides. The situation remained at a deadlock for a year after hostilities had been concluded. Then American organizations undertook an unofficial negotiation of exchange of prisoners, this being afterward followed by the appointment of committees by the League of Nations for that purpose (see text, page 564).



Photograph by Harry Drucker

READY FOR A SECOND HELPING

Refugee children on the Island of Syra, the commercial center of the Cyclades. The capital of the island, Hermopolis, owes its founding to an earlier influx of refugees—those from Chios and Ipsara, who settled here after the devastation of their island homes, in 1821-22.



Photograph by Carris E. Mills

A CARAVAN OF CHRISTIAN REFUGEES TRAVELING TO A RELIEF FARM NEAR RODOSTO



Photograph by S. R. Vinton

A CAMP SCHOOL FOR CHILDREN OF REFUGEES AT SALONIKI

The Anatolian Greeks, exiles for many centuries from their native land, spoke a tongue different from that spoken by the Greek proper. Therefore the first duty of the Greek Government was to teach Anatolian Greeks to speak Greek.



Photograph by H. C. Jaquith

THE TYPE OF REFUGEE HOMES BUILT BY THE GREEK GOVERNMENT IN THRACE



Photograph by C. D. Morris

CHILDREN MAKING BRICKS AT RODOSTO, ON THE SEA OF MARMORA

Immediately upon emerging from tent life (see illustration, page 586), the transferred peoples began to utilize the local clay and build themselves houses (see text, page 564).



Photograph by C. D. Morris

AN OPEN-AIR BARBER SHOP FOR REFUGEES IN RODOSTO

of two rooms to a family, went on in those stucco suburbs, which eventually will change the appearance of every major city in Greece. The urbans, with their racial instinct for trade, performed wonders in the way of self-rehabilitation, and before long they were paying nominal room rentals and bidding competitively on shop rentals, with the Commission as landlord.

The Commission will continue in its part-paternal, part-directorial, part-creditor function—accepting debit slips against agricultural supplies, occasionally financing some new trade, and always with permanent colonization as its goal—until such a time as the final settling up occurs between the two governments, several million people, and itself, and the books of the Exchange are closed with a red line.

GREECE, WITH ONE-FIFTH TURKEY'S AREA,
HAS 1,500,000 MORE PEOPLE

Meanwhile, one may perhaps strike a trial balance of results. Turkey, now about one-fourth larger than Texas, is left with a population of 5,000,000, of whom four-fifths are Turks. Her natu-

rally rich, but undeveloped, territory contains only 15 people to the square mile, yet at last she has a national homogeneity upon which to base her future. Except for the Constantinople Greeks, whose fate lies with the League of Nations, her religious and racial minority problems have been wiped out; she herself has sponged the slate.

Greece, with less than one-fifth of Turkey's area, emerges with a population exceeding the latter's for the first time by 1,500,000 people and averaging 123 to the square mile.

HISTORY'S GREATEST TREK HAS COST
300,000 LIVES

If the last traces of classic Ionia have vanished from Asia, the motherland, in receiving back the descendants of her Pilgrim Fathers after three thousand years, acquires a sturdy, invigorating stock of grain producers and, moreover, of industry transplanters, who have brought with them the crafts of silk-weaving, rug-making, and ceramics.

As to the cost of history's greatest trek, conservative estimates place it at 300,000 lives lost by disease and expo-



COPYING A RUG DESIGN

Among other results of the transfer of Greeks from Asia Minor to Greece is that the traditional arts and crafts of these people, such as rug-weaving, are now taking root for the first time on the mainland of Greece.



Photographs by Harry Drucker

GREEK GIRLS WEAVING RUGS

This is one of the trades that is now being imported into Greece from Asia Minor as a result of the transfer of populations (see text, pages 564 and 584).



REFUGEES CROSSING THE MARITZA ON A RAFT PULLED BY ROPES



Photographs by Frank America

A TENTED CITY ON THE MARITZA RIVER

Here tens of thousands of Greeks camped after having fled from Thrace before the incoming Turks (see text, page 557).



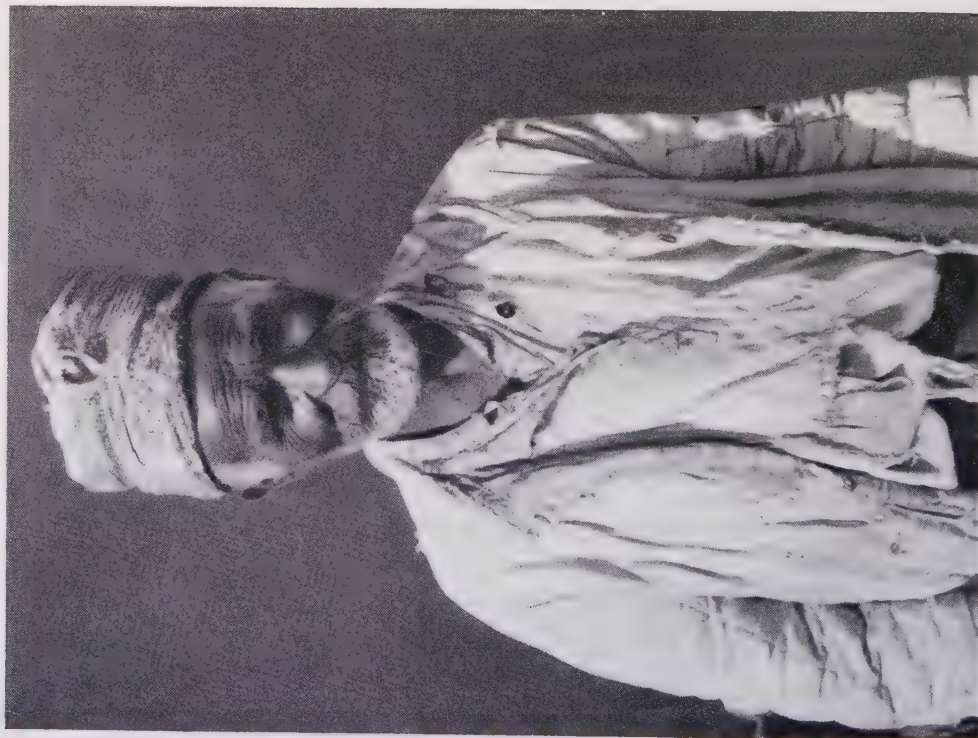
HOUSEKEEPING IN THE REFUGEE BARRACKS AT SALONIKI



Photographs by S. R. Vinton

INTERIOR OF A GREEK REFUGEE CAMP IN MACEDONIA

The refugees themselves partition off the extremely limited space by building low walls around each family (see, also, text, page 559).



Photograph by Lex W. Kluttz

THE LOSS OF THREE SONS IS WRITTEN IN HIS FURROWED FACE
He is one of the deportees from Greece, his former home being Mitylene,
his present abiding place Adalia.



Photograph by S. R. Vinton

AN ANATOLIAN GREEK REFUGEE GIRL

Her eyes show that she has seen horrors more awful than even the
imagination of ancient Greek dramatists could conjure up.



THEY HAVE NOT WHERE TO LAY THEIR HEADS

These exiled mothers and their babies are Anatolian Greeks. The photograph of the mother at the left was taken before her departure from eastern Asia Minor; those at the right, after their arrival in Thrace.



Photograph by Frank America

sure and at an expenditure mounting beyond \$100,000,000.

By the winter of 1924 the human tidal waves of two years' duration had subsided. One could walk along the Near East's sea frontages, as after some great storm, and note the changes wrought. There was Saloniki, its quay lined with crescent-curved sailing craft, archaic as Troy, with their final quotas of ex-changees; the last-arriving Greek boys staring broadly at the last-departing Moslem boys, speech between them being impossible, since the Greeks spoke only Turkish and the Turks spoke only Greek; the ramshackle, burned-out city already sprouting into cement suburbs for housing 25,000 Greeks, and the business-as-usual proclivities of Giorgios or Demetrius being everywhere visible, even though it be only nuts and oranges atop a packing box on the dingy midway of tented refugeedom.

And there was Kavala, its tangled streets haunted by the white ghosts of deserted minarets; its tobacco warehouses unloading their glut of temporarily sheltered immigrants in exchange for the crop of 40,000 farmer colonists. The latest arrivals camped in wild valleys pierced by the ancient Roman road. Here, with tents, bedding, grain, frost, and fresh air as the extent of their mixed blessings, they seemed marvelously cheery and progressive, with their bake ovens consisting of rock-paved holes in the hillside, a grocery store created out of mud-plastered reeds and a case of spaghetti, and even a hand-carpentered bench with a coffee machine and a bottle of *dousicko* on top of a dry-goods box, as the makings of an embryo café.

CONSTANTINOPLE, STILL GLORIOUS BUT
FADED

And Constantinople—still glorious, yet a bit faded and shorn; her harbor almost

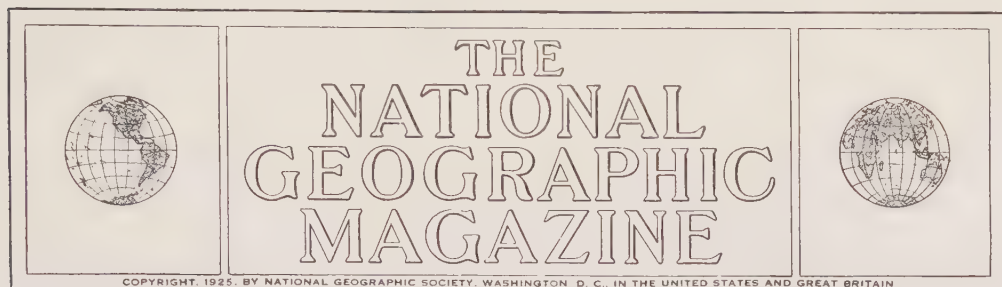
deserted, her Greek quarter fast diminishing, her foreign embassies preparing for transference to Angora, and, above all, her Sultanate and Caliphate abolished by Republicanism, and her last royal seraglio gone, like the poisoned cup and secret bowstring, down the dusty centuries. For so long the peerless mistress of conquerors and poets, to-day she seems wondering if she hadn't better remove the rouge, let out the lacings, and grow old gracefully into a museum.

And Athens—somewhat out at the heels from financial overstrain, somewhat bare, as after the passage of locusts; her port swarming with commerce as are her suburbs with 60,000 immigrant citizens housed in stucco settlements; her English poet sympathizer memorialized in the Byron Settlement, where Missolonghi Square leads one to Anatolian Greeks weaving in Tom Moore Street or rug-knotting in Maid of Athens Street; her sky-framed Parthenon looking down on these by-products of the 1922-1924 drama, a drama so strange, so moving, that only Greece's classic poets could have interpreted it—Sophocles, perhaps, querying the enigma of human suffering in a tragedy called "The Exchanged."

The solution to that enigma, as it relates to the Exchange, was, perhaps, personified in an ancient, grizzled, square-capped Greek fisherman who knelt one morning on the shore of a little Peloponnesian harbor, painting a name on the stern of a boat. He had abandoned his own craft in some Asian village during the Exchange, and a storm had beached this rudderless, fish-smeared derelict near his hut. He had wiped out the old bloodstains and refitted her for his fresh start in life.

The name that he painted, while kneeling there on the seashore under the Ægean's glowing dawn, was *The New Hope*.

Notice of change of address of your GEOGRAPHIC MAGAZINE should be received in the office of the National Geographic Society by the first of the month to affect the following month's issue. For instance, if you desire the address changed for your January number, the Society should be notified of your new address not later than December first.



THE TAURINE WORLD

Cattle and Their Place in the Human Scheme—Wild Types and Modern Breeds in Many Lands

BY ALVIN HOWARD SANDERS, D. AGR., LL. D.

EDITOR "THE BREEDER'S GAZETTE," AUTHOR OF "THE STORY OF THE HEREFORDS," "SHORTHORN CATTLE," "A HISTORY OF THE PERCHERON HORSE," "AT THE SIGN OF THE STOCK YARD INN," ETC.

*With Illustrations in Color from Portraits Painted from Life by
Edward Herbert Miner*

WE are accustomed to think of cattle as merely the source of the milk and cream, the butter and cheese, the roasts and steaks, that enter so extensively into the human dietary, in all except the torrid zones of the earth. Few of us stop to consider, in connection with the part played by man's most valuable friend in the animal kingdom, that the actual contribution of cattle to human needs by no means begins and ends with the foods that make up so much of our commissary.

Once upon a time thousands of cattle were raised and slaughtered on the pampas of Argentina, as well as on the coastal plains of the Gulf of Mexico and seaboard California, solely for their hides and horns!

In those then-remote parts there was no market for either beef or milk because there was neither refrigeration nor adequate transportation. Now, all that is changed; and yet, in the very heart of our richest agricultural States, where every consideration demands a better beast, one may see in almost every community, and in every central stockyard market place, cattle that yield about as much leather,

glue, tannage, bone meal, buttons, and toothbrush handles as they do of edible products.

This fact accounts in great measure for the existing high development of the huge American packing-house industry. Everything—good, bad, and indifferent—is grist that enters the packer's mill.

NOT ALL CATTLE LIVE UP TO THEIR PICTURES

As we drive up and down the highways and byways of our country we may observe here and there, in roadside pastures, cattle that bear close resemblance to the color illustrations in these pages, and at the great cattle shows—East, West, North, and South—one will easily recognize, after a study of these plates, the Shorthorn (the "Durham" of our fathers), the Hereford, the black, hornless Aberdeen-Angus, the Jersey, the Guernsey, the Holstein-Friesian, and other improved varieties.

Notwithstanding the easy availability of all these highly specialized bovine types, however, it must be acknowledged that average cattle are of inferior quality, in spite of all the efforts of the Government,



© H. Armstrong Roberts

A FRIEND OF THE COW

There is no food so valuable for young children as milk and its products. It contains all of the body-building elements essential to their growth and development.

the agricultural colleges, the livestock press, and others interested in supplanting the plain, everyday "scrub," or native cow, with something infinitely better adapted to the profitable production of high-grade beef and dairy goods for human food.

CATTLE PRODUCE MANY SIDE LINES

Forgetting for the moment the food that patient cattle put upon our tables, let us consider other products which are being fabricated through all those days and nights afield for our comfort and our arts and industries. A cow has a hide. On that hide is hair. There is use even for the "switch" swinging at the end of the tail. Ask upholsterers, furniture and mattress makers as to that. Probably there is some of it in the cushions of your motor seat, as you protest against stray cattle standing in the roadway.

And cows have ears. Inside the ear a fine hair grows. This the packer carefully clips out, sorts into little bundles,

and the product finds itself presently masquerading as a "camel's-hair" brush with which artists may, perchance, paint bovine pictures!

From the hide is made the leather out of which the suitcase you carried around Europe last summer was manufactured; likewise the handbag, your pocketbook, your boots and shoes. Then, too, there is the gear with which the horses of the world are harnessed, and a good percentage of the belting which turns myriad wheels.

Horns and hoofs! One holds a product of the former in his hand whenever an umbrella or walking stick of a certain fashion is carried. Combs, hairpins, barrettes, buttons, and knife-handles also are made from horn, while pipestems, powder-puff tips, crochet needles, and tiles with which one plays Mah-Jongg come from the bones of cattle as well as from the tusks of elephants. When ground into meal, these same bones feed our



© Charles J. Belden

THE CALL OF THE WESTERN WILD

The instincts of his wild ancestors sometimes assert themselves so vigorously that the range bull bellows forth a challenge to the world.



© Albert Schlechten

"THE CATTLE UPON A THOUSAND HILLS": A FAR-FLUNG HERD ON A MONTANA RANCH

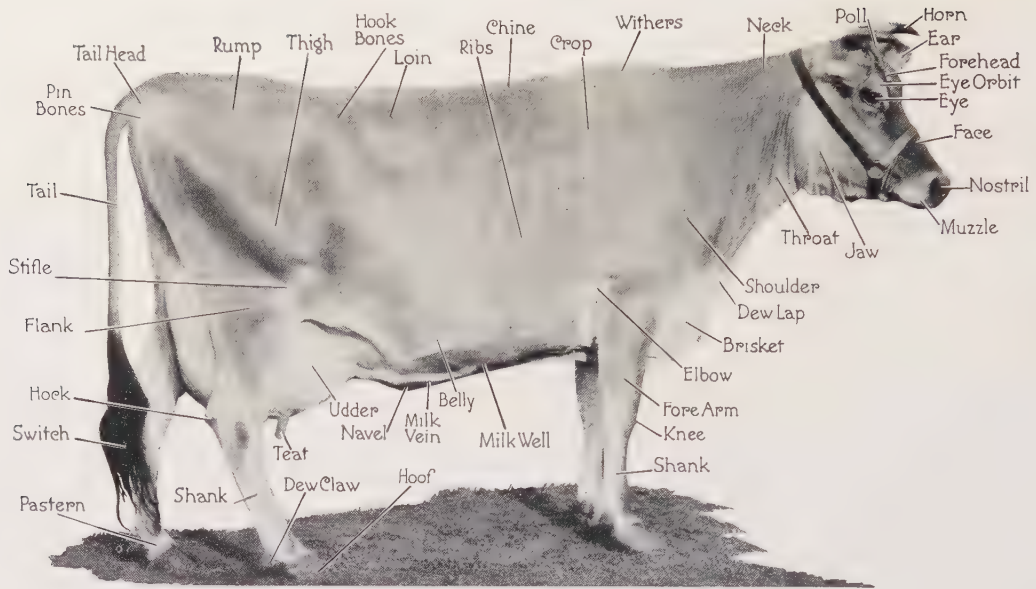
These cattle are emerging from their winter quarters into the spring sunshine and are spreading over plain and mountain slope in a search for the most succulent patches of pasturage in the vicinity of Bozeman. The United States, with 65,000,000 head, leads the world in aggregate value of cattle (see text, page 597).



Photograph by Charles J. Pelden

A WINTRY DAY IN THE SAGEBRUSH COUNTRY

Cattle supposedly find their winter food on this part of the range, but sometimes a cold snap immediately following a snowstorm will cause a hard crust to form on the snow, rendering it impossible for them to break through to the grass beneath. At such times provident ranchmen draw upon their supply of hay.



THE NOMENCLATURE OF THE DAIRY COW

lawns and pastures, thickening and invigorating the grass from which they were originally produced, and, when converted into charcoal, make a filter used in refining sugar.

Glue and soaps, candles, cosmetics, oleomargarine, and glycerin, tankage, blood-meal, and the trainloads of commercial fertilizer that feed the land and make tillage and trucking possible upon many otherwise sterile soils, likewise come in large measure from cattle.

In the stomachs of "veals" is found the curdling ferment known as rennet, used by pharmacists and a prime necessity in cheese-making; from a tiny gland upon the surface of the brain of cattle we derive an extract, valued in medicinal preparations, known as "pineal substance." Unfortunately, there is in each animal but one pineal, of the size of a pea; so that it takes 15,000 cattle to produce one pound of product!

Science has also contrived to fashion a substantial list of manufactured articles from milk, of which casein is the chief nitrogenous element. It is the "curd," the first and principal use of which is for making the cheese so rich in nutrients; but this same casein is also an ingredient in the manufacture of telephone receivers, combs, fan handles, cigarette holders, and various other articles in daily use. It is

also an important constituent of the coating for the paper on which the NATIONAL GEOGRAPHIC MAGAZINE is printed and which is in part responsible for the high quality of its illustrations.

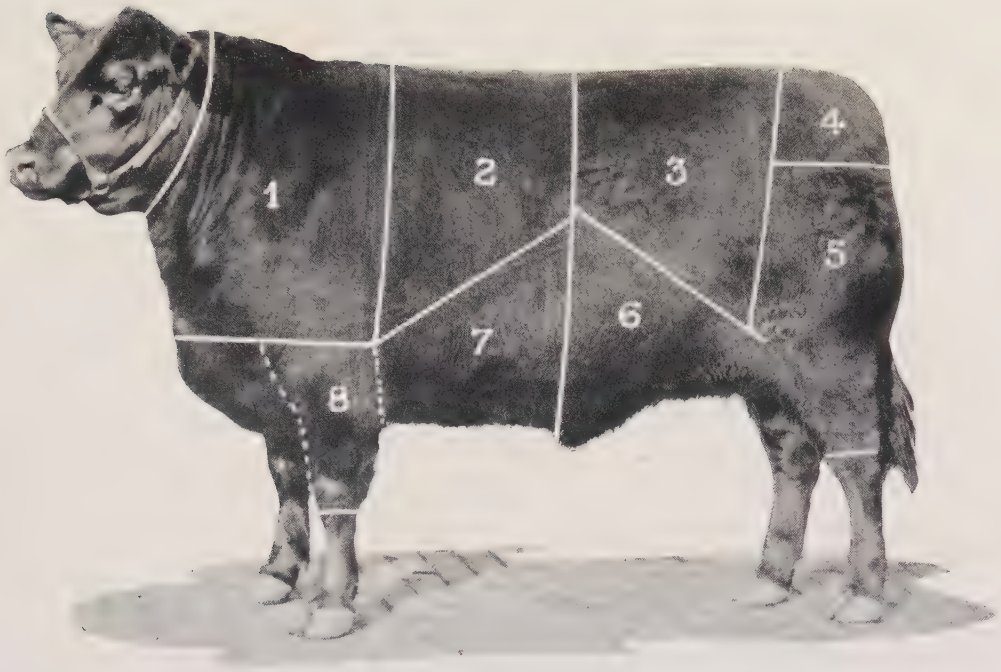
WHY A COW CHEWS HER "CUD"

Is it any wonder such a benefactor of mankind chews her cud with infinite complacency?

The cow, the camel, the bison, and the buffalo; the yak, the deer and elk and antelope, the sheep and the goat all have the cud-chewing habit; and while so indulging themselves are apparently at peace with the world.

This habit is formed as soon as the young begin eating roughage or solids of any kind, hay and grain being offered to calves after they are 10 days old. These foods are first received unchewed into a commodious anteroom, the rumen, which is not a true digestive organ. A second receptacle, containing fluid, acts with the first, but only after the rumen is well stored with food and water does the cud-chewing performance begin.

It is the churning of the food by involuntary muscular action, together with action by the second stomach and lower part of the gullet, that causes the formation of the so-called "cud," which is regurgitated when the animal is at rest.



THE CUTS OF BEEF

1, The "chuck"; 2, the rib; 3, the loin; 4, the rump; 5, the "round"; 6, the flank; 7, the plate; 8, the shank. The plate extends forward under the shank and includes the brisket.

After being chewed and mixed with saliva, a cud or bolus—containing, in the case of cattle, about three or four ounces of food—is ready for digestion by the other stomachs.

THE CATTLE CENSUS

The world's cattle stocks are estimated in round numbers at 500,000,000 head; but this total includes Asian and African figures, upon which no great reliance can be placed; more especially the estimate dealing with Russian and British India possessions. Domesticated buffaloes enter to some extent in the East Indian estimates, and, on account of the disturbed conditions prevailing in Russia, there are no satisfactory figures available for that vast expanse of territory.

The United States, with its total of around 65,000,000 head, leads the world in point of aggregate valuation.

Great Britain stands supreme in the per capita valuation of her insular cattle possessions, because of the comparatively small number of substandard cattle upon her farms.

Argentina is rich in herds, and since the

erection of great *frigorificos* at Buenos Aires, and the entrance of American packers into that vast area of supply, exports largely to Old World markets.

Australia has also developed an important cattle-growing industry, and by resorting to improved English breeds has come into the possession of herds that contribute, since refrigeration became a part of the equipment of British ocean-going freighters, to the Smithfield (London) market.

While Great Britain originated most of the world's best breeds of cattle of the beef-making types, her industrial development has so far outstripped her agricultural production, and her people consume so much more beef per capita than those of any other European country, that more of that product from foreign sources annually enters her seaports than those of any other nation.

The Englishman, like "Brother Jonathan," loves his good roast beef; but, unlike the latter, fails to grow enough to satisfy his own demands. In former years the United States shipped great numbers of live bullocks from the Corn



Photograph by Charles J. Belden

HEELING A CALF

This is the Western parlance for catching a calf by the hind legs. The more expert ropers always use this method instead of the easier one of roping the calf by the neck, as it is not so liable to injure the animal. The loop of the lariat can here be seen circling around the legs of the little fellow in the foreground.

Belt for slaughter at Deptford and Liverpool, but that trade is now practically a thing of the past.

Modern methods of refrigeration have enabled South American, Australian, and New Zealand ranchmen to cut heavily into the American export business in dressed meats for the British markets, the cost of production in the Southern Hemisphere being so much below that of our own country that Chicago packers have been compelled to invest heavily in Argentina in order to hold a share of the regular transatlantic business.

PROVISIONING THE WORLD
IN WAR AND PEACE

Continental Europe is not a large consumer of beef, but lamb, poultry, hams, bacon, and dairy products enter extensively into the dietary of the people. In America and Great Britain beef is a staple article on all bills of fare, and fortunately for our own country we have not only the great grazing grounds of the arid West, but the unmatched corn crop of the central valleys to admit of beef-making in America upon a scale not approached elsewhere in the world.

Argentina can grow the Indian corn, the greatest animal-fattening food known, and does so in moderate quantities, but will probably never equal the United States in its production.

Napoleon asserted that armies travel on their stomachs. The troops of the Entente Allies in the World War were the



© Merl La Voy

CUTTING OUT CATTLE IN QUEENSLAND: AUSTRALIA

The great plains of this island continent provide excellent pasturage for cattle and sheep. Although wool-growing is the more important industry, the exports of beef and hides amount to many millions of dollars annually. The white faces and red bodies of the animals shown in this picture reveal the blood of the English Hereford (see Color Plate XI).



Photograph by William R. Barbour

CROSSBRED PAMPAS CATTLE OF ARGENTINA

The owners of great *estancias* (ranches) have brought the original Spanish stock up to a modern beef standard mainly by the extensive use of Shorthorn and Hereford bulls imported from England and now bred in large numbers in Argentina. The Shorthorn is in particular favor. Brahman bulls have also been used to a comparatively limited extent for crossing purposes. "Once upon a time cattle were raised and slaughtered in Argentina solely for their hides and horns" (see text, page 591).

best-fed soldiers of whom history has record. Refrigerated, cured, and tinned meats from the United States supplied the solids of the "mess" that sustained the forces of Britain, France, and the United States during that eventful contest of physical endurance. The organization and the enormous resources and facilities of American packing plants alone made it possible properly to supply the Allied troops on foreign soil.

The vast quantities of beef forwarded regularly by the United States during the extended period of hostilities demanded strenuous efforts upon the part of American cattle feeders to meet this sudden, imperative demand; and the equally sudden disappearance of war-buying by the Allied governments was responsible for the financial distress that overtook Corn Belt meat makers, rangemen with large commitments, and the packers themselves, when the signing of the armistice precipitated wholesale liquidation in a war-inflated industry.

All had been operating upon a basis of high-production costs; lands had mounted

to valuations resting upon the insecure foundation of steers, hogs, and sheep at around \$20 per hundredweight, wheat at \$2, and corn at \$1.50 per bushel! Farm labor, owing to the draft, was cut short and help was almost unobtainable.

Sheer was the descent from apparent prosperity to adversity. The American cattle growers have indeed paid their share of the prodigious material cost of the conflict overseas, in hundreds of pathetic instances, by loss of lands, homes, and the savings of a lifetime.

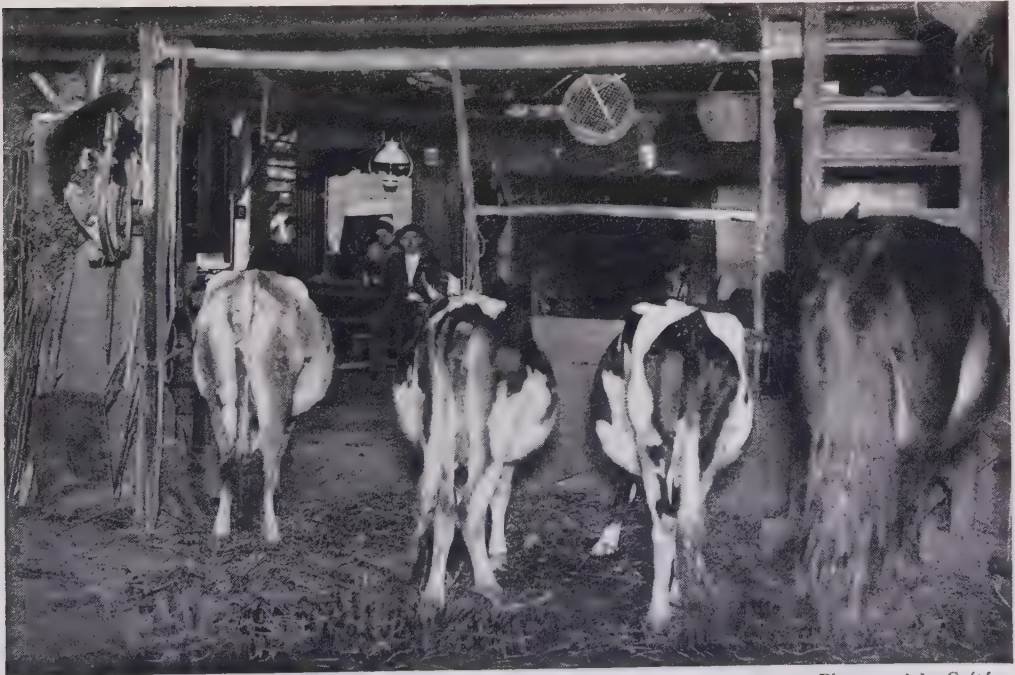
The Far West cattle business will be years recovering from the passing of the tidal wave that first rushed prices up to abnormal heights, only to be followed by a recession to abysmal depths. Slowly the readjustment is being brought about, but this is a chapter in the economic history of a basic industry that cannot be fully treated here.

While beef among all Anglo-Saxon peoples is synonymous with brawn, and therefore contributes heavily to the fighting strength of their arms, it is of equal potency in the case of Anglo-Saxon labor



Photograph from Lieut. Col. Alfred Heinicke

MASTER AND MILCH COW: SOUTH GERMAN TYPES



Photograph by Crété

COWS IN THE KITCHEN

In parts of rural France and other continental countries it is not uncommon to see the farmhouse and stable built together. One of the cows in this picture appears actually to be standing in the kitchen.



© Charles J. Belden

"THE DRAGS," OR REAR END OF A TRAIL HERD

From the original Andalusian stock brought to the New World by the Spanish *conquistadores* sprang the vast numbers of Longhorns which roamed the plains of the Southwest a hundred years ago. As the business of cattle ranching developed during the past century, these native cattle were crossed with other breeds, improving the range stock to a marked degree.

in mills, mines, forests, factories, and fields. When to that we add the wealth of vitamins and vigor contributed by the dairy cow to infancy, youth, manhood, and old age by the milk, cream, butter, cheese, and other products, now available in a multitude of palatable forms, we may begin to comprehend the part played by cattle in the upbuilding and sustenance of nations.

GOOD BEEF FOR EVERYBODY

Unfortunately, the American public is altogether too indifferent as to the *quality* of the beef to be obtained from the average vender of meats. Aside from a comparatively limited demand for strictly prime corn-fed beef from certain clubs, hotels, and high-class restaurants in the larger cities, there is a very narrow outlet for the rich, finely-marbled beef which could be produced by American farmers in great volume if consumer's would only insist upon having it. Consumers must learn the lesson that very lean meat is always tough meat, and that the muscular tissues of animals are only made tender and full-flavored by the presence of plenty of fat.

The Department of Agriculture has recently prepared colored plates for general distribution, illustrating the difference between good beef and the inferior cuts, and a general awakening upon the part of the American public in respect to this important subject would mean much to our farmers at this time. We have the breeds and we have the feeds, yet our people consume vastly more poor beef than good.

That is not true in the case of butter. The public would not stand for low-grade dairy products. Why are not housewives as particular as to quality in meat as they are in regard to butter? They have the remedy in their own hands, if they will only apply it. Insist upon better roasts, steaks, and chops, and they can be obtained. The finest in the world are produced here in our own country, and yet our feeders and breeders suffer losses constantly because the public puts up with almost anything offered in the way of fresh meats.

Reform in this direction lies at the

bottom of a more successful animal husbandry in the United States.

THE SONG OF THE BELL

Throughout immemorial ages there has existed between men and the Taurine tribes a most intimate relationship. The ministrations of the herds to humankind have been continuous and beneficent through all generations. Anything, therefore, that brings assurance of the nearness and safety of the cattle to the descendants of a nomadic ancestry arouses a certain elemental sense of peace, security, and comfort.

In that fact is found the psychology of a certain satisfying reaction registered by almost every human mind at the sound of cowbells tinkling somewhere in the distance, from across green fields, as darkness settles down upon the earth.

Those mellow notes, so dear to the memories of the rural-born, are not now heard so frequently as in the pioneer days of our country's history; but in the remoter farming districts, and, of course, in the Swiss Alps, one still may hear rustic harmonies as the kine take the homeward trail, their founts brimming from long midsummer days afield.

WHERE "BOSSY" GETS HER NAME

Naturalists list cattle, buffaloes, and bison as near relations in the *Bos* branch of the animal creation. Hence the term of endearment frequently applied to the family cow. She is "bossy" by right of strictly scientific assignment. What we commonly call a Buffalo is not a Buffalo at all. His right name is Bison, and he has a cousin known as the Yak—he with the long skirt of dark-brown hair extending well down his short legs, seen in zoölogical gardens and menageries (see Color Plate III and text, page 640).

The real Buffalo (commonly Water Buffalo) is domesticated in the tropic East, and is a useful beast of burden in the Philippine Islands, India, and other hot regions of the Orient (see Color Plate V and text, page 641).

The Yak is a central Asian product, and in his domesticated state is thought by some to represent a cross of the wild Yak bull upon some type of domesticated cow of the Taurine tribe.



Photograph by Smith and Morton

A POLLED HEREFORD BULL

While it has been commonly accepted that the original wild cow was horned, there have long been well-defined races of hornless or polled cattle. Indeed, certain scientists contend that the polled type is the original *Bos taurus*. Hornless calves, known as "mooleys" or "muleys," occasionally appear in almost all of the improved horned breeds, and it is not uncommon for these mutations to reproduce their own peculiarity. This polled Hereford bull is a fine example of the hornless type of English "white-face" developed in the United States in recent years by systematic attention to the polled characteristic.

There is a recognized ancient relationship between the Gaur, the great wild ox of Asia, the Yak, such East Indian humped Bibovines as the Gayal and the Banteng, the various buffaloes, the Bison, and our cattle proper. If there be such a thing as a connecting link between the Bisontine and the Taurine (cattle) groups, some authorities maintain that it was probably the East Indian Gayal, or Jungle Ox, the native habitat of which was

the mountain forests east of the Brahmaputra.

The Gayals were forest rangers, avoiding the plains and valleys. They browsed off shrubs and tender shoots of trees and grasses. In color they were various shades of brown, with white markings on legs, bellies, and tips of tails. In size they were not unlike the common ox, and were not only docile under domestication, but so fleet of foot that the natives sometimes used them under saddle. The females yielded rich milk, and the Hindus would not shed their blood, holding them in the same veneration as the sacred Brahman cow (see Color Plate IV and text, page 640).

THE URUS AND THE CELTIC SHORTHORN

Aside from the Brahman breed, of remotest Indian origin, it is believed that all present-day types of cattle known in Europe and the Americas are descendants of two aboriginal races, one large and commonly known as the Urus, and the other the so-called Celtic Shorthorn. The former ranged throughout western Asia, northern Africa, and practically all of Europe. It is said to have had a hairy coat, varying in color from black and dark brown during the summer months to gray in the winter. It had a white or grayish stripe along the back, and the ancient Teutons knew it as the Aurochs.

Cæsar in "De Bello Gallico" called the animal the Urus, such as he had known



Photograph by Charles J. Belden

THE END OF THE TRAIL

In the great stockyards of Chicago, Kansas City, Omaha, and other centers the stockman finds a cash market for his cattle.

in the Hercynian forest, and described it as "approaching the elephant in size, but presenting the figure of a bull." Fossil remains indicate a height of six feet at the shoulder.

The widely distributed wild Celtic Shorthorn was decidedly smaller than the Urus and had a shorter face, but a longer and broader forehead. In color the Shorthorns were solid, shading from blackish brown to gray.

THE WILD WHITE CATTLE OF TO-DAY

Speaking broadly, our larger breeds of cattle are supposedly of Urus origin and the smaller of Celtic Shorthorn derivation.

The nearest kin to the Urus at the present time, according to most authorities, are the so-called Wild White cattle of Great Britain (see Color Plate VI), preserved, as a matter of scientific interest, upon various landed estates, as illustrated by the herds at Chillingham Park, Northumberland, the property of the Earl of Tankerville, and at Cadzow Forest, Lanarkshire, Scotland, seat of the Dukes of Hamilton. The lapse of centuries, however, has so changed these specimens that they approach their alleged forbears neither in color nor in size.

The Uri of the Continent were "commonly black or mouse brown," and this is held to explain the fact that the Wild



Photograph by H. A. Strohmeyer, Jr.

THE LOWING HERD WINDS SLOWLY DOWN THE LANE

These cows are "golden Guernseys," the adjective being applied because of the rich yellow color both of the milk and butter they produce and of their own skin. Channel Island farmers have always laid great stress upon the relationship between the color of the skin and the color of the butter (see text, page 676).

White cattle of the British parks not infrequently show black markings.

The Cadzow Forest breed has jet-black tips of horn, black tongues and muzzles, black hoofs and black hair at the knee-cap, and sometimes black stockings. The Chillingham cattle, on the contrary, commonly have red ears, and black spots in the skin are sometimes observable.

It has been suggested that the Uri of the present mainland, reaching northern Britain during times when the North Sea was probably a plain and in an age when only the lowlands had emerged from the ice sheet, in the course of centuries took on the white color usual to Arctic animals and birds to meet the conditions of a frigid environment. This, however, is mere surmise.

In their ancient habitats, the operation of the natural laws of environment and the survival of the fittest shaped wild

cattle types to meet their several requirements. Nature makes no mistakes in that respect.

FIRST STEPS IN DOMESTICATION

In the regions where man probably first brought cattle under subjection, the types available, in obedience to the laws just mentioned, were neither heavy-bodied flesh-bearers nor deep milkers. The quest for food and water called for activity and muscular development. In fact, shortness of leg, compactness of body, and a tendency to put on fat, distributed throughout the entire carcass—the distinguishing characteristics of our modern beef breeds—would have been distinct handicaps in primeval grazing grounds and forests.

Still, Nature apparently deemed it wise to provide some sort of storehouse in certain cases against a day of possible want.



© H. A. Strohmeyer, Jr.

"WHEN A FELLER HAS A FRIEND"

This happy young American is posing with a purebred Guernsey on a New York dairy farm. Many years ago one of the Empire State's county banks printed its notes in golden yellow as a token that from butter came the prosperity and riches of the community.



Photograph by Belle Johnson

BUCKET-FED BABIES

Dairymen commonly wean their calves at an early age, and as a result many of them are mothered in this way.

Hence, it is argued, the hump of the Indian cattle and the camel, and the fat caudal appendage of certain species of sheep.

As to milk flow, it is obvious that in a wild state none was needed beyond the requirements of the young. When man first undertook the domestication of wild cattle, the animals possessed only those characteristics demanded by their own existence, without producing a surplus for any other purpose.

Man was, for a time at least, content to accept the wild types as he found them; and in the early nomadic ages he followed the herd about in its instinctive search for food, just as certain North American Indians followed the Bison's migrations at a much later date in human history. The cattle did the work; man lived off their labors.

There came a time, however, when the nomads began to have local habitations. This called for arrangements whereby the

cattle could be maintained near by, without being compelled, or permitted, to wander far afield. Grasses for their use were conserved; forage necessarily provided. Man began to supply the herd with that which previously the cattle had to seek, as best they could, for themselves.

Better keep and a more limited range made for improvement, since all animals respond to generous feeding. This, therefore, was the beginning of greater capacity for supplying human wants. Then, by and by, it dawned upon the ancient herdsmen that it would be a good plan to try to control propagation in the interest of better conformation and increased production, and therein lies the genesis of modern stock breeding.

THE HERD WAS EXALTED BY ANCIENT CIVILIZATIONS

Greek and Roman mythology abounded in bovine recognition. The Farnese Bull and other marbles, and the skull still used



© H. Armstrong Roberts

JUST A BITE BETWEEN MEALS: GUERNSEYS

Wisconsin, Pennsylvania, New York, and Minnesota are strongholds of the Guernsey. Nearly a quarter of all the purebred representatives of the breed are to be found within the borders of the Badger State.



Photograph by J. Russell Morse

AGRICULTURE IN TIBET

The pair of Zos led by the woman are half-breed animals. They are a cross between the male Yak and female Zebu, and are much more docile animals than the purebred Yak, which is often surly and undependable and does not take kindly to the plow. After the land has been plowed and cross-plowed, it is leveled in the fashion shown here. While the woman leads the Zos, a man stands atop a plank which is dragged over the broken ground.

in architectural and interior mural decoration, indicate that in art, as well as in religious and other ceremonial rites, kings, priests, and men of great affairs—the rich, the poor, the mighty, and the humble in every walk of life—regarded cattle as a part of the national heritage to be exalted and preserved almost as a sacred trust.

The greatest sacrifice that could be made to propitiate the powers supposed to dominate the destinies of men was the offering of the most valued member of the herd. The Grecian urn, immortalized by Keats, depicted a familiar scene:

"To what green altar, O mysterious priest,
Lead'st thou that heifer lowing at the skies,
And all her silken flanks with garlands drest?"

In Egypt the cow was sacred to Isis. Gaily decorated cattle were favorite forms of gifts among the Latins, and Vergil represents Queen Dido as presenting to the companions of Æneas "twenty fine bulls, an hundred bristly boars, an hundred ewes, with each a well-fed lamb."

According to Aristotle, the dorsal-humped Zebus, the sacred cattle of ancient Hindustan, were found in Syria before the Christian Era, and Grecian sculptors gave a dewlap to their oxen that resembled that of the Zebu; but, aside from this, the Greeks depicted no other characteristics of the Indian breed. The Egyptians, as well as the Greeks, in their figures of the zodiac always outlined the conformation of the ordinary ox.

THE OX AT THE YOKE

The Hindus, Greeks, Egyptians, Romans, and Hebrews, all revealed affection for the herds inherited. Cattle were not then, as in these modern days, valued merely for what they could be made to yield in the satisfaction of human wants. They were made partners in the fêtes and gala celebrations. Crowned with wreaths, they were paraded as an integral part of triumphal pageants. They were, however, partners in work as well as play.

The ox was extensively used at the



Photograph from Keystone View Company

INDIAN WATER BUFFALOES IN THE JUMNA RIVER, NEAR DELHI, INDIA

These beasts will stand in the water for hours at a time with only their heads and backs showing.

yoke by the ancients, as he is to this day in various parts of the world, including our own northern New England States and in the southern Appalachian regions. The Greek poet Hesiod, in his "Works and Days," the oldest-known work upon agriculture, gave this advice as to the oxen on the farm:

"For draught and yoking together, nine-year-old oxen are best, because, being past the mischievous and frolicsome age, they are not likely to break the pole and leave the plowing in the middle."

Early maturity was clearly not a char-

acteristic of the Grecian herds. The same author preaches good care and "preparedness," as follows:

"The cattle should be kept in good condition, and ready for work, when the migratory crane's cry bespeaks winter's advent and the prospect of wet weather. Everything should be in readiness for this; and it will not do to rely on borrowing a yoke of oxen from a neighbor at the busy time."

The Hindus and Hebrews, by practice and precept, protected the ox from abuse by his owner. A Scriptural edict ran,



Photograph from Jonkheer J. Loudon

WATER BUFFALOES IN THE DUTCH EAST INDIES

The plow being used to cultivate this muddy rice field consists simply of a forked stick tipped with iron as a blade, attached to a straight pole which serves as a handle. Although primitive, such a plow is best adapted to the peculiarities of rice culture. The miniature shocks in the foreground are young rice plants, which have been taken up by the roots from the nursery field and are now ready to be transplanted.

"Thou shalt not muzzle the ox when he treadeth out the corn."

Roman writers were especially insistent on humane treatment of the ox: "The length of a furrow should not exceed 120 paces, or else that the oxen shall have a time for breath." The plowman is required to "shift the yoke, that their backs be not galled," and exhorted to "moisten their mouths with water, and to strengthen them with wine when suffering from fatigue." To destroy them wantonly was a punishable crime against the State.

In Biblical days worldly riches were

measured largely in terms of herds and flocks. The Roman word for "money" was *pecunia*, from *pecus*, cattle, and in all antiquity it is apparent that cattle were prized possessions.

The Scriptures abound in references to the reliance placed by the patriarchs upon their herds. When Jacob and his brethren were called by Joseph into Egypt, they were presented to Pharaoh as men whose "trade hath been about cattle from our youth even until now, both we, and also our fathers."

The ancient law threw every protection



© Wiele and Klein

WATER BUFFALOES IN THE SURF NEAR THE CITY OF MADRAS, INDIA

"The real Buffalo is domesticated in the tropic East, and is a useful beast of burden in the Philippine Islands, India, and other hot regions of the Orient" (see text, page 603).



Photograph by Clifton and Company

MILKING A BUFFALO

Many of the native tribes of India maintain great herds of Buffaloes for the sake of their milk and butter. Buffalo milk is very rich and makes excellent cheese, but it is thick and has a peculiar flavor that does not appeal to the average American palate.



Photograph by Plâté, Ltd.

THE COVERED WAGON IN CEYLON

around ownership: "If a man shall steal an ox, or a sheep, he shall restore five oxen for an ox and four sheep for a sheep."

TORCH-BEARING BULLOCKS EMPLOYED BY HANNIBAL

According to Livy, the ox played an important part upon one occasion during the Punic Wars. The Roman historian thus credits Hannibal with having effected the escape of his army from a well-laid trap set by Fabius Maximus for the destruction of the invading host: "Two thousand oxen, with lighted pine torches tied to their horns, were driven into the hills at night, thus presenting the appearance of a moving army." Under cover

of this diversion the Carthagenians slipped through the net!

In one of his most delightful sketches dealing with English characteristics, Emerson points out the intensely practical bent of the British mind and, among other illustrations of the way in which they manipulate things to serve their own purposes to the best advantage, says:

"The native cattle are extinct, but the island is full of artificial breeds. The agriculturist Bakewell created sheep and cows and horses to order, and breeds in which everything was omitted but what is economical. The cow is sacrificed to her bag; the ox to his sirloin."

One has only to see a record-breaking dairy queen, or a modern Christmas bul-



Photograph by Frank Scott

INFLATED CATTLE SKINS SERVE AS RIVER CRAFT TO THE HINDUS

lock, to appreciate the humor of the idea of a cow that has found herself turned into a mere annex to an udder of gigantic proportions, or of a fat steer that wanders about on short pegs supporting a mountain of meat!

The modification of the forms and functions of the leading types of domesticated animals through human intervention to meet various needs and differing environments was not made the subject of intensive study for many centuries. The story of Jacob's little trick upon Laban in the placing of the famous rods before the breeding cattle suggests, however, that

some attention was given by the patriarchs of old to attempts at prenatal control of the character of progeny.

The Romans were students of breeding types and the problems relating thereto, as reflected by Columella and various Latin writers. That attention was paid in Vergil's time to blood lines in the mating, and that the branding iron of our Western ranges is no new invention, are revealed by these Georgic couplets:

"Strait stamp their lineage with the branding fire;
Mark which you'll rear to raise another breed,
Which consecrate to altars, which to earth
To turn its rugged soil and break the clods."



© Underwood and Underwood

A BUFFALO CARAVAN IN MANCHURIA

The Peking Pike is a wonderful stone-ballasted, well-graded road extending across Manchuria and Chosen (Korea). It is probably older than the famous roads built by the ancient Romans and has ever been a highway of tremendous strategic importance in the East. Manchurian farmers are driving their cattle to market laden with sugar cane, bamboo, and rice shoots.

Improvement looking toward more generous milk production antedated efforts at adding to flesh-making proclivities. A Biblical expression for a particularly favored land was one "flowing with milk and honey." Due to climatic conditions, the south Asian and Mediterranean sea-coast peoples have never been, and are not now, large consumers of beef. Milk and yoke-service were the objects specially sought in their cattle-breeding operations.

Modern Taurine history, up to comparatively recent years, centers along the shores of the English Channel. All of the world's most widely disseminated improved cattle types at the present time have been originated either in Great Britain, upon the continental mainland immediately opposite, or in the islands off the coasts of Normandy and Brittany.

With the single exception of the valuable contribution made by the Swiss, we



Photograph by Winfield Dudgeon

A HILLSIDE IN INDIA WHERE GRAZING COWS HAVE CREATED A VAST NETWORK OF PATHS

In some of the mountainous parts of India the slopes are so steep that the cattle have to graze most intensively to obtain sufficient sustenance. Where such search for food has been carried on for a long time, diamond-shaped systems of paths have been created by the cattle.

must credit to the British, Dutch, and French the great herds that now make up the pastoral wealth of Europe, the two Americas, and Australasia. To the British we owe practically all the breeds that best enable feeders to produce prime beef. To their neighbors of the Netherlands and the Channel Islands must be assigned a credit in the dairy world, the magnitude of which is reflected in the three words—Friesian, Jersey, Guernsey!

The Bretons and their cousins of old Normandy have not attained wide distribution of their useful cattle outside their own boundaries. Our North American cattle are practically all of British, Dutch, Swiss, and Channel Islands origin.

While milk was for ages the primary object sought by most keepers of cattle, the present perfection of dairy form and capacity is, as in the case of the beef and dual-purpose types, a comparatively modern development.

In no department of the animal breeder's art has achievement reached higher

levels than has been recorded in the case of the Jersey (see Color Plate XII), the Guernsey (see Color Plate XIII), the Holstein-Friesian (see Color Plate X), the Ayrshire (see Color Plate XVIII), and the Brown Swiss Cattle (see Color Plate VIII). Of these the black-and-white Dutch and the Channel Island groups are numerically the most important in the United States.

ENGLAND'S LOVE OF ROAST BEEF BROUGHT ABOUT NEW TYPES

The Ayrshire, Great Britain's solitary contribution to the special dairy division, has, however, gained powerful support in recent years (see text, page 699).

The English were not satisfied with milk alone. John Bull is too carnivorous by nature to be content with anything but the choicest of meats, and so he early set about the creation of the Shorthorn, the Hereford, the Aberdeen-Angus, and other breeds that cut rich beef in every part of the carcass (Color Plates VII, XI, XIX).



Photograph by Fred Bremner

TIBETAN TRANSPORT

The narrow rails of steel which dissolve distance have not yet scaled the heights of the Himalayas or penetrated the depths of all their valleys, and the hardy, though ill-tempered, Yak still constitutes the Tibetan transportation system.



Photograph by William Reid

WEST HIGHLAND COWS AND CALVES

These animals, often called Kyloes in their native land, have been made familiar to the outside world through the art of Sir Edwin Landseer. They are a small, rough-coated mountain breed, having long horns. The original Kyloes were mainly black, but lighter colors—dun, red, fawn (and an occasional white with black points)—have since been established and are now preferred. They are essentially a beef type, and when fattened in lowland parks and feedlots produce a fine, though small, carcass of beef.



Photograph by Charles Reid

A PEG-LEGGED BOSSY

This cow broke her leg when young, and the owner, not wishing to see her destroyed, had a veterinary surgeon supply a wooden leg. She goes about in the fields with the other cows in dry weather, but when the ground is wet she has to stay indoors, as the wooden leg sinks in the earth and she is extricated with difficulty.

It was not until Robert Bakewell of Dishley, a Leicestershire farmer of an inquiring turn of mind and possessed of rare reasoning faculties, began his experiments in blood concentration as a means of definitely fixing desired characteristics that modern beef-cattle breeding received its first great impetus.

This was during the reign of King George III, and it is characteristic of the high consideration given even before that era, as well as at the present moment, by British royalty, nobility, and landed gentry to the improvement of the domestic animals of the kingdom, that His Majesty took a deep personal interest in Bakewell's work.

The good example thus set percolated down through the whole fabric of citizenship to the farmer himself!

The Dishley experiments were carried on with a long-wooled breed of sheep known as Leicesters, and with a type of cattle at that date (1755) locally popular in Lancashire and adjacent counties, un-

der the name of Longhorns—so called because of their exceptional length of horn.

Bakewell's aim in the case of the Leicesters was not to increase the quantity or improve the quality of the wool, but to increase the amount of flesh in the carcass.

The principle that "like begets like" had long been accepted as a general truth, but Bakewell was the first to demonstrate that the close interbreeding of the offspring of animals possessing desired characteristics established a prepotency not otherwise attained. His object in the case of the Longhorns was the same as with the Leicesters—to produce a type carrying more flesh (and especially in the most valuable parts of the carcass) than the breed at that date possessed.

He sought beef, not milk, and by close mating of the progeny of animals selected because of their (as yet "unfixed") excellence in that direction, he accomplished his purpose. He found that breeding from close affinities tended to reduce size and



Photograph by A. Gaddis and G. Seif

A CARVING IN THE TEMPLE OF SETI I AT ABYDOS: EGYPT

Prince Amenherkhepshef and his father, Rameses II, are shown catching a bull for sacrifice. Such tail-twisting is still common among the Arabs of to-day, who accompany the "caress" with the shout, "Get up, sweetheart!"

vigor, and set up a certain delicacy of form which experience taught was favorable to the process of fat secretion, leading to earlier maturity than was the case with the unimproved prototypes.

Bakewell's contemporaries who were engaged in producing the flesh-bearing breeds naturally were quick to apply the new policy; and if it enabled a breeder to establish early maturity and heavy-fleshing propensities, by parity of reasoning it would enable breeders of milking stock easily to accentuate udder development. In short, the principle was universal in its application and was resorted to in almost every branch of animal breeding as a sure and swift means of establishing any desired characteristic.

DIFFICULTIES AND HIGH ACHIEVEMENTS
OF THE BREEDER'S ART

There is truth enough involved in Emerson's whimsical reference to Bake-

well's work to emphasize sharply the artificiality of all "improved" breeds of animals. Such udders as are carried by our best modern dairy cows are unthinkable in the case of any normal specimen of the Bovine race. In a state of nature, no cow has any use whatever for the marvelous lacteal equipment fastened upon her by man's manipulation.

All cattle measuring up to the modern human idea as to what they *ought* to be are most assuredly *not* improved from the standpoint of the animals themselves. Hence the first thing that Nature undertakes to do for them, when man withdraws his supervision, is to begin restoring them to their ancient form.

An artist, modeling in plastic clay or conjuring with marble, brings forth a conception that the world acclaims a triumph. He deals, however, with his materials direct, and they respond instantly to his lightest touch, as he toils toward



© Asahel Curtis

A HERD IN THE FAR NORTHWEST

A cloud of dust rises as the cattle move forward on the floor of the Grand Coulee at the head of Steamboat Rock, formerly an island in the Columbia River.

a preconceived ideal. There is no resistance to his manipulations.

What, then, should be our estimate of the work of one who has first to conceive the figure in his brain; whose only tools are the laws of heredity, selection, inbreeding, outcrossing, and alimentation; whose only materials are flesh and blood, unapproachable except by indirection; who battles ever against the stubborn forces of atavism or reversion to ancestral forms; who seeks, and succeeds in producing, a creature pulsating with life, exquisitely fashioned, down to the minutest detail, not only a thing of beauty in itself—which artists try, sometimes with ill success, to reproduce on canvas or in bronze—but a creation that serves as well the highest utilitarian purpose?

The breeder of animals (or plants) directs the spark of life itself. The possibilities of his art are almost infinite.

CATTLE NOT INDIGENOUS TO THE WESTERN HEMISPHERE

No trace has been found of the existence of native cattle of any type in North or South America. The Bison was the only bovine creature found by the Spaniards during their explorations, and it was not what they were looking for.

Alvar Nuñez Cabeza de Vaca, treasurer of Narvaez's abortive Florida colony, and the first white man to cross the Continent of North America, was also the first to leave posterity a description of the Bison.

This explorer was shipwrecked in 1528 on the Texas coast, and after being enslaved by the Indians for almost six years, made his escape across Texas into Mexico (1535-6). Though he encountered no Bisons on his wanderings across this vast territory, being too far south, he had, however, met some of these strange animals probably near Matagorda Bay. Here, he says, the Indians "come up with the cows; I have seen them thrice and have eaten their meat." Then he goes on to describe the "cows," as to size, hair, and habitat.

About 1540 Mendoza, viceroy of New Spain, acting under instructions from the Spanish Crown, organized an expedition to search for the fabled "Seven Cities of Cibola," said to be located somewhere in the north, beyond the Rio Grande. Glow-

ing tales of these had reached the ears of the king's representatives in what is now Mexico, and they determined to locate and, of course, exploit the reputed riches of those Indian capitals.

Francisco Vásquez Coronado, then governor of a province lying between the City of Mexico and the Californian Gulf, was chosen commander of the expeditionary force organized for this purpose, and, while disappointment, in so far as gold was concerned, followed his return after a prolonged absence, the fact remains that this proved one of the most important, besides being one of the most daring, explorations ever conducted upon this continent.

CORONADO'S "COWS"

Coronado proved to be the Columbus of the great uncharted sea of sand, sagebrush, and grassy, treeless plains that lie between the Grand Canyon of the Colorado and the lower reaches of the Platte. He passed through central Kansas as far north as the present Kansas-Nebraska border.

The Seven Cities were found in what is now the Zuñi Indian country of western New Mexico; but instead of treasures of precious metals, only a group of primitive villages, populated by peaceful aborigines, who grew maize and beans and melons and possessed little that could excite Spanish cupidity, rewarded the invader's long march from central Mexico. They "make the best cakes I have found." That was about all that Coronado seemed to think distinguished them from other southern Indians he had known.

So, after securing a few trinkets as souvenirs of the "Seven Cities," he listened to what proved to be grossly exaggerated tales of wondrous wealth existing toward the east; and, not proposing to return empty-handed, if this could by any possibility be avoided, he made his plans for extended explorations.

First, he had a small party reconnoiter westward, just to make sure that he had not been deliberately misled. Then another proceeded as far as the Grand Canyon, after which the expedition set its course squarely toward the rising sun. This brought Coronado presently out upon the Llano Estacado of our old geographies, and there he found the Bison.



© J. E. Stimson

THE FINE ART OF SWINGING A LARIAT (SPANISH "LA REATA") AS EFFECTIVELY PRACTICED ON UNRULY STEERS

The picturesque cowboy life which added so materially to the romance of years past on the Western plains has not entirely disappeared.

Fortunately, Coronado and his associates prepared, after their return, a detailed account of the great journey, which was subsequently published in Spain. From this we learn that "the only roads are those of the cows," and that "the cows are as numerous as the fishes of the sea!"

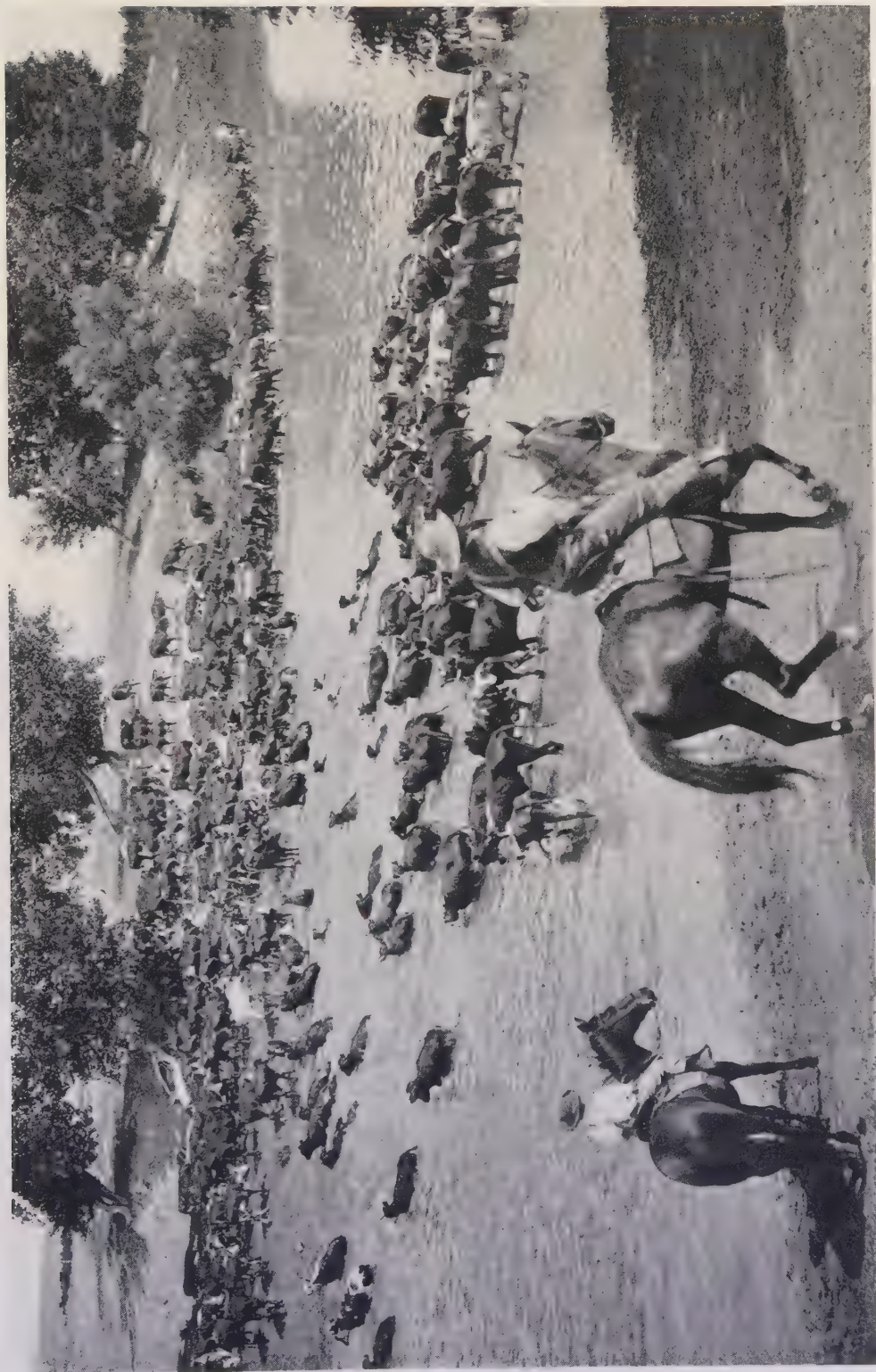
Thus the American Bison first comes conspicuously into the pages of our national history, and in this connection the account adds:

"There are bands of Indians who travel around with the cows, and do not plant, but eat raw flesh and drink the blood of the cows they kill; dressing themselves with the skins, and making little tents also of the hides."

COWBOY LAND

Cows are still in the region explored by Coronado, but not the cows of his time. They are not so numerous now as in the Bison days, nor as in the recent past. As a matter of fact, the red-with-white-face herds of Herefords one sees here and there as one whirls through the dry Southwest supply a more or less pathetic sequel to the greatest bovine epic of recorded history.

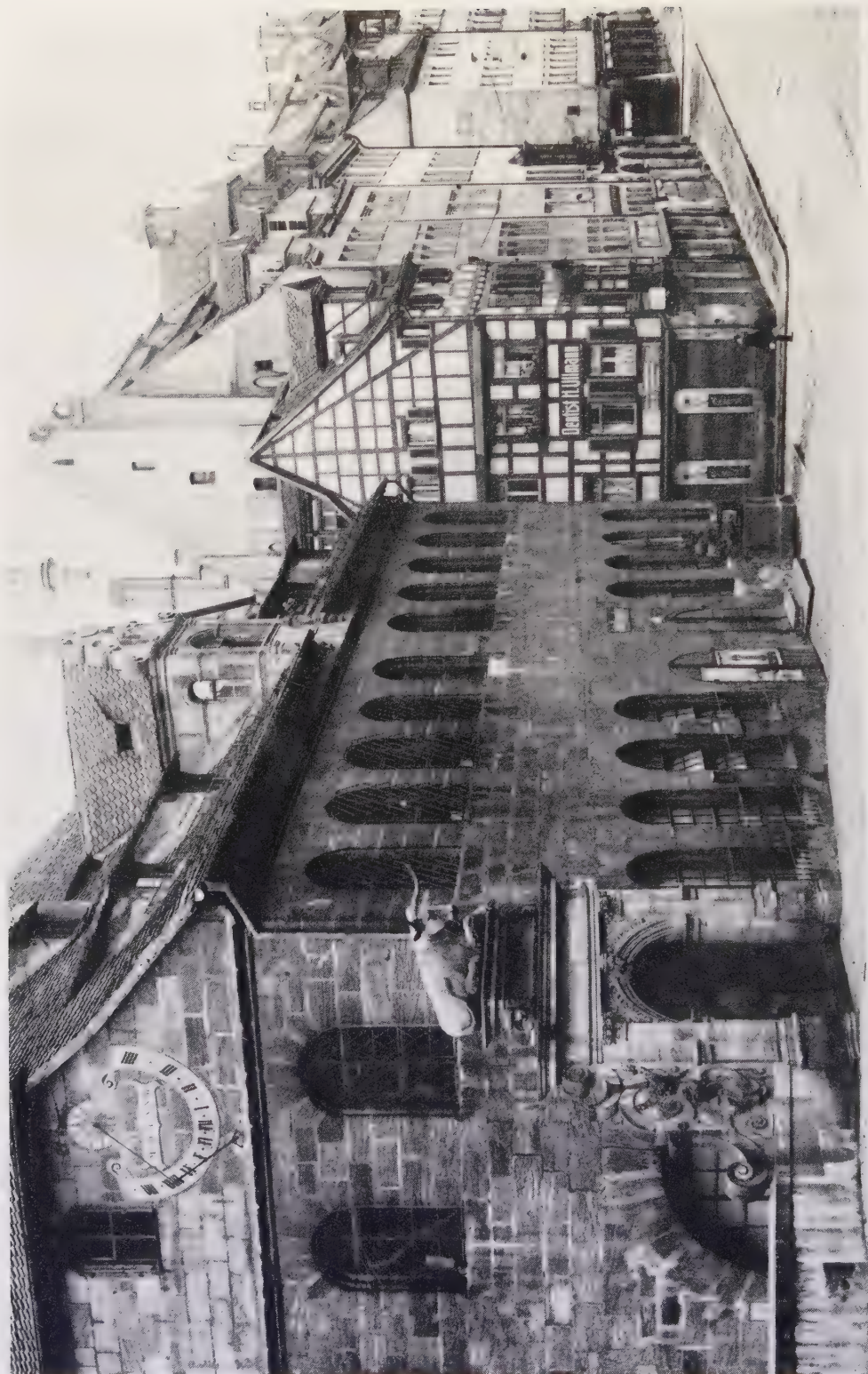
Behind those herds there is a story unparalleled in kind in any land, a story spectacular and dramatic, brimming with adventure and romance, replete with acts of heroism, as well as of crime, of fortunes quickly won and lost.



Photograph by Sumner W. Matteson

FORDING THE MILK RIVER: MONTANA

On this ranch the sombrero, bandana, "chaps," and lariat of the typical cowboy have given place to more modern headgear and suspender overalls.



THE HOUSE OF THE BUTCHERS' GUILD IN NUREMBERG, GERMANY
The great stone ox was placed over the entrance to the Fleischbank (Meat Hall) in 1599.

The cowboy and the old-time Western "cattle king," as once known on the range, have long since passed from view; but we must make a detour to attain perspective.

Great herds of Longhorn cattle moving slowly northward from the Rio Grande for the prologue! The dashing hero-villains of the "movies," in picturesque array! The perils of the long, long trail! The night-alarm and call to saddles, as strange sounds or shadows in the darkness start the wild stampede! The cowland "capitals," where six-shooters flourished as the bottle and the "deal" went round! The branding and the round-up of the beef! Midsummer's burning suns and drouth! Midwinter's blizzards! Wolves waiting for their turn! Bleaching bones of cattle! Gambling for big stakes against elemental forces—all of these are constituents out of which the story is woven.

The Spanish Longhorns were first taken to Mexico in 1521 by Governor General Villalobos, and were calves shipped from Santo Domingo, descended from the cattle brought from Spain to the West Indies in the years immediately following the voyage of Columbus. These must have been succeeded by other shipments, for in 1538 Mendoza reported that cattle, horses, and merino sheep, which he had imported from Spain, were in good condition.

The early Spanish explorers of the country north of the Rio Grande, including Coronado, Fray Marcos de Niza, and Onate, took horses, cattle, and sheep into that region, and these were undoubtedly the first of their kind upon what is now our Southwestern range.

All writers agree that the original cattle stocks multiplied rapidly in New Spain. That they invaded at an early date the fertile coastal plain, with its mild, even climate, extending from the mouth of the Rio Grande up along the western shore of the Mexican Gulf, may be taken for granted; but it was not until the Spanish authorities undertook the development of that country through a colonization policy that we find authentic records. This was about the year 1810.

When Texas became one of the United States, in 1845, and governmental affairs became more stable, the importations of

first-class breeding stock, mainly Short-horn, from Missouri, Kentucky, and other cattle-growing States did much to improve the Longhorn. It is unfortunate that few of the early writers took the trouble to give the characteristics of the old Longhorn-Spanish stock. About the only description recorded is that "they were a wild, fierce breed, with huge horns, long legs, and worth little or nothing to their owners."

The Longhorns (see Color Plate XX) were peculiarly adapted to the task of leading the great advance into the higher western latitudes and out upon the arid grazing grounds of the Staked Plain. They possessed amazing energy and endurance and had what may be termed "cow sense."

When bands of mixed cattle were common on the plains and deserts of the West, it is worthy of note that the Longhorns led the herds in their migrations. These cattle felt the "call of the wild," had weather wisdom, and knew where to find grass and water. They were admirable mothers, and their calves, sired by "Durham" or Hereford bulls, were excellent.

AN EARLY "CATTLE BARON"

Whatever may have been their faults, judged by the standards of latter-day beef-makers, it must be said that the Longhorns not only served every purpose required of them at the time, but constituted the best possible material for use by those who first sought to put cattle ranches on the map of our new possessions.

The extension of United States authority over the Lone Star State and the discovery of gold in California in 1848 resulted in an influx of population and capital that soon exerted a stimulating effect upon the production of cattle throughout southern and north-central Texas, as well as beyond the Sierra Nevada. The herds began to be valued for beef, as well as for hides, horns, and hoofs; and thus the infant industry of cattle-raising in a commercial sense came into existence in the Southwest.

Richard King, who had been a steamboat captain during the Mexican War, engaged in the transportation of freights



Photograph by Clifton Adams

AN ELECTRIC MILKING MACHINE IN USE AT ONE OF THE DAIRY BARN OF THE SOLDIERS' HOME: WASHINGTON, D. C.

and supplies along the Gulf coast and up the navigable streams, was so impressed by the grazing possibilities of the region between Brownsville and Corpus Christi, Texas, that he obtained a tract of some 50,000 acres lying between the Rio Grande and Nueces River, which he at once stocked with horses and Longhorn cattle.

Upon this property in 1854 the headquarters of the once world-famous million-acre Santa Gertrudis Ranch was established and our modern American ranching had its earliest important exemplification.

Cattle and horses of the common Mexican types were purchased and roamed at will over the arid plain that had the brackish waters of the Nueces River for its northern boundary. In the meantime the proprietor made an outlet for his cattle by slaughtering them for their hides and tallow, which products he hauled to Corpus Christi, the nearest port on the coast.

The raising of cattle for their hides was so obviously a wasteful procedure that the attention of capitalists was drawn to the opportunity for profit afforded by such conditions. Before the outbreak of the Civil War two plants had been established near Rockport, Texas, at a place called Fulton. One was occupied mainly in canning fish and green sea turtle, but added a desiccating department for making beef extract. The other plant was the Coleman Fulton Packing Co., which packed beef in salt as pork is packed, but the main revenue was derived from corned beef. New York City capitalists, including "Commodore" Vanderbilt, are reputed to have had an interest in one or both of these concerns.

Captain King was soon joined in extensive cattle-grazing operations by his old companion in the coastwise steamship trade, Captain Mifflin Kennedy, who also acquired large holdings. Together they made rapid progress in their enterprises.

Numerous attempts were made to improve the quality of their herds, but little headway was recorded in this direction for many years. In the first place, there were no improved breeds nearer than the distant blue-grass pastures of Kentucky. Transportation was tedious and expensive, and, worst of all, it was soon discovered that Northern cattle taken to those Southern plains almost invariably succumbed to a fever the nature and origin of which were not understood at that time.

LONGHORNS WERE IMMUNE TO PLAGUE

The Longhorn thrived and multiplied untouched by the mysterious plague, but the Northern cattle either died or were left mere wrecks of their former selves. We now know that this was the work of the tick that infests the lowlands of the lower latitudes, against the toxins of which the native cattle were immune.

It was upon this same great Santa Gertrudis Ranch that the veterinarians of the United States Bureau of Animal Industry worked out in later years many of the problems relating to the so-called Texas, or splenetic, cattle fever (see page 631).

The early Mormon immigrants to Utah were instrumental in fixing the cattle stocks of that region, for these settlers took with them good milking cows, largely of Shorthorn blood. In the early eighties Utah still had many descendants of these valuable milch cows, and many a ranch was stocked with cattle bought in the Mormon settlements.

These animals had the habit of milk-giving too strongly pronounced to be ideal range stock, as the cows frequently lost parts of their udders from having more milk than their calves could take, and they were such persistent milkers that they were apt to go into winter too thin in flesh. They were, however, ideal mothers for the creation of grade Hereford herds.

OVER THE SANTA FÉ AND OREGON TRAILS

On the Pacific coast the situation was somewhat similar to that in Texas. In the extreme south the Spanish stock still prevailed in its natural state, but a steady stream of settlers from the Middle West, seeking their El Dorado at the end of the Oregon and Santa Fé trails, had driven

many a beast of Shorthorn or Devon extraction across the Great Divide, where, under climatic conditions favorable to Northern-grown animals they had planted the seeds of substantial improvement.

Thus it came about that in both Oregon and California a start toward a higher standard had been made at a comparatively early period. In all these instances the cross of the Shorthorn on the Longhorn had increased the size, leveled the carcass, and improved the fleshing capacity of the cattle.

Texas has been well described as the hive from which swarmed the cattle that spread all over the region west of the Missouri River. Far removed from the devastating effects of the Civil War, the Texas herds increased, and the demand for beef for both armies added to their value. Then came the period of the trail herds to the north to reach the newly built transcontinental railroads.

BARBED-WIRE FENCING HAD ITS PART

So long as the Texas ranges were free and open to all comers, no general effort was made to improve the herds. About 1889, when the fight for "free grass" was lost, the State, which owned all its lands, began to issue leases or to make sales of land in large tracts, which the owners could inclose with barbed-wire fences.

Farsighted pioneer Texas cattlemen, like John Chisholm, Colonel Slaughter, Martin Childers, Burke Burnett, Ike Pryor, the Reynolds brothers, and many well-organized cattle companies, like the Continental ("Mill Iron") Co., the Matador, the J A (John Adair), the great Santa Gertrudis Ranch of Captain King, and last, but not least, the big Capitol Syndicate Outfit in the Panhandle (X I T), together with half a hundred others, not one of them owning less than 20,000 head of cattle, then began to breed up their herds.

Breeding was greatly stimulated by the demand for steers to stock up the open and unoccupied Northern ranges of Wyoming, Montana, Nebraska, and Colorado that developed so quickly after the late seventies.

The progressive ranchmen soon realized that it cost no more to raise a purebred than it did a "scrub"; the quieter, well-

bred steers ate no more grass and tramped out far less than did their Longhorn brethren.

When the Texas cattlemen awoke to the need of better blood, there arose at once the question of Texas fever and its deadly tick. As early as 1865 the records show that some mysterious disease followed the introduction of cattle from that State into States to the north. The trail herds that found their way across the plains to Abilene, Cimarron, Dodge City, Fort Hayes, and other shipping points along the new railroads in Kansas brought death to the local cattle.

Wherever the herds from Texas grazed across the Northern ranges local cattle died in large numbers. The Texans stoutly denied the charge that their cattle brought the disease, alleging that their stock was healthy, and that the losses were due to local conditions. So heavy were these, however, that the Northern stockmen took drastic measures to protect themselves. Trail herds reaching the Kansas State line were met by armed men, who refused the Texans passage across their ranges.

Not until 1891 was the cause definitely located, when Dr. Cooper Curtice, of the Bureau of Animal Industry, established the fact that a tick found on nearly all the cattle from Texas east of the 100th meridian, as well as on those of other Southern States below a certain line, carried the germs which caused the spread of the fatal fever. By a series of rotations in the use of pastures, the Government authorities began to clean up the Southern ranges with such success that the "tick line" has now been pushed far below the northern boundary of Texas and other Southern States, and eventually the whole region will be free from this disease.

"THE LAST OF FIVE THOUSAND"

Between the late seventies and the beginning of the present century the range cattle business had a marvelous expansion in the Northwest. In fact, during that period it reached its zenith and entered into a decline that culminated in the great financial debacle of 1923.

This development began with a heavy movement of Southern-bred "stockers"

into Montana, the Dakotas, and Wyoming, filling the Great Plains region to the point of overstocking. Grass was free and the business for a time proved profitable. Capital was available in apparently unlimited amounts. Cattle-ranching became invested with a glamour that attracted adventurous spirits, Old World capitalists, and all sorts and conditions of men.

For a time all went well. Then came the greatest catastrophe the industry had yet encountered, the bad winter of 1886-87, which brought the whole great Northwest gambling structure tumbling to the ground. It was a period of Arctic severity that all but wiped out many of the leading operators.

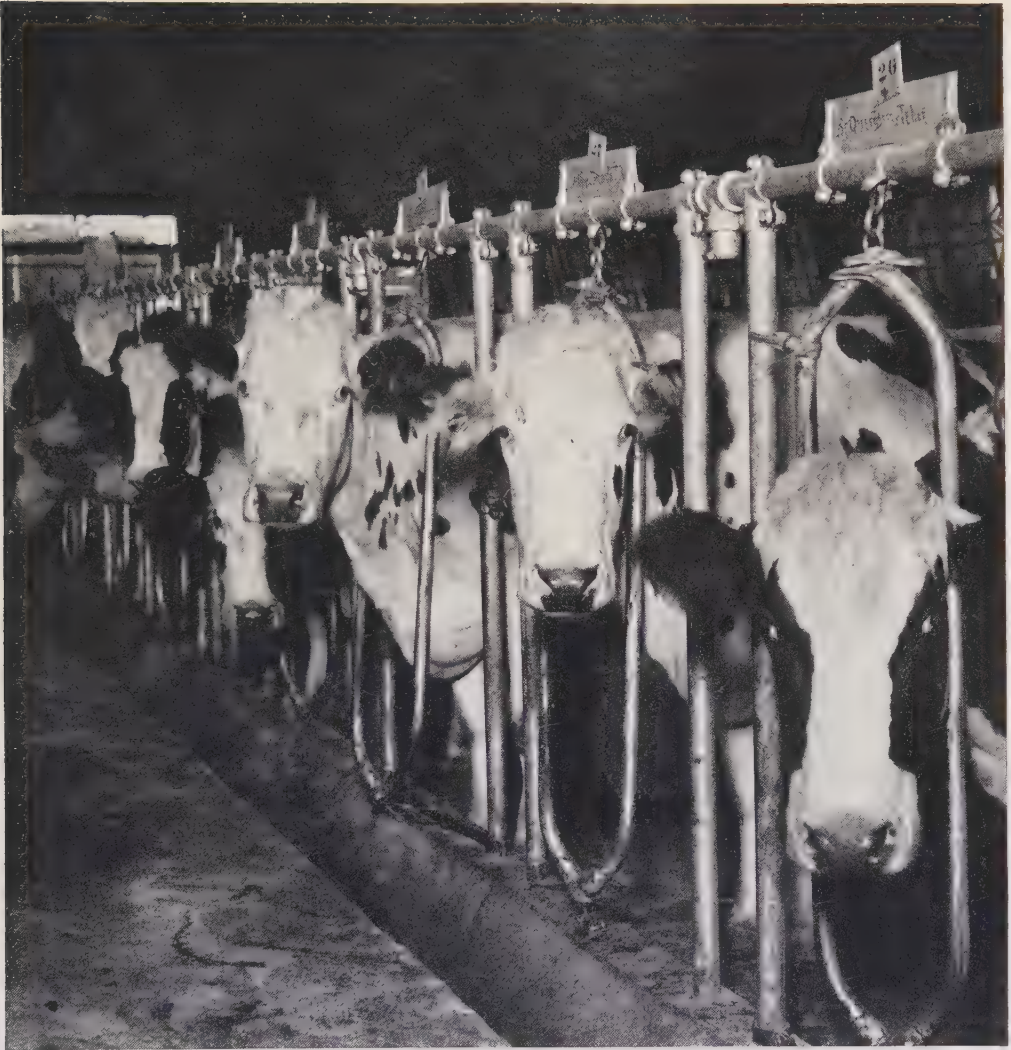
At the close of that winter "Charlie" Russell, later a noted animal painter, of Great Falls, Montana, who was then in charge of a big herd, was called upon for a report. He responded by drawing a picture which is to-day a classic in the cattle country. Underneath a solitary, emaciated steer, standing on a snow-covered mound and encircled by expectant wolves, he wrote, "The Last of Five Thousand!"

DRY FARMERS ROUT CATTLEMEN

Texas had plenty of cattle in those days for rehabilitation purposes, and capital came to the relief of the cattlemen, enabling them to restock. The business again entered upon a brief period of prosperity. The hardy white-faced Hereford had proved to be well adapted to the open range, and that blood to this day finds greater favor on the grazing grounds of the West than any other (see page 672).

During the period preceding this great disaster the entire Northwest, from the Missouri River on the east, the Niobrara on the south, to the Canadian line and beyond, was full of cattle, so full that the natural pastoral wealth of the region was fairly dissipated, due to overstocking, which inevitably heralded the decline of the industry.

Pastures were destroyed and settlers invaded the range—the advance guard of the army of dry farmers who in recent years have suffered so severely at the hands of implacable Nature. The latter, however, forced the big-herd owners to



Photograph by Clifton Adams

DEHORNED HOLSTEIN-FRIESIAN COWS AT THE U. S. SOLDIERS' HOME, WASHINGTON,
D. C., WAITING TO BE MILKED

These generous producers trace their lineage back through generations of pure-bred ancestors. Each cow upon entering the big barn proceeds immediately to the stall bearing her name. The herd supplies milk, cream, and butter for the approximately 1,300 men resident at the Home.

withdraw by creating a condition in which it was impossible to make beef. Cattlemen resisted the inevitable, but the handicap was insurmountable. A few surviving big herds sought safety temporarily behind fences on Indian reservations, but even they are now passing out of the scene.

This period saw the development of the fenced-pasture area on the Standing Rock and Cheyenne reservations in

North and South Dakota. Annual replenishment of these pastures was continued until 1923, when increasing overhead expense prevented the purchase of young cattle. Now it seems probable that the industry in the Northwest is to revert to a business of home breeding, under which the annual increase will be sold either at weaning time or at the yearling or short two-year-old stage.

Since the European war developments



Photograph by Donald McLeish

DRAFT OXEN OF THE REPUBLIC OF SAN MARINO

Practically all the roads in this tiniest of republics, with an area of only 24 square miles, have terrific grades, and the draft animals are necessarily powerful.

have been rapid. Commercial cattle have all but disappeared from the Great Plains, except where enjoying security behind fences.

THE DAY OF "BABY BEEF"

In the mountain regions the small herd has multiplied, and will probably feature the next chapter in the history of the industry. It may mean fewer cattle in the aggregate, but probably more beef, in consequence of better breeding and care, and a shorter production or maturity cycle. The new Western cattle industry will not be on a purely speculative basis, as was the old.

Early maturing as a factor in profitable

beef-making has attained its greatest strides during the past 25 years. What was called the "behemoth bullock" was standard in the early days; now the pony steer has displaced it. The first International Live Stock Exposition carlot show at Chicago in 1900 presented hundreds of three- and four-year-old fat cattle. Now it is a display of yearlings, with a few two-year-olds.

In 1869 the display of Christmas cattle at Chicago included droves weighing up to 2,000 pounds. One has only to contrast these weights with the bulk of the show cattle now seen annually at Chicago to realize the enormous change that has occurred in market requirements.



Photograph by Camillo Schneider

HUNGARIAN OX TEAMS

It has been assumed that the Hungarian Ox is descended from the Giant Ox, or *Bos taurus primigenius*. He is large-framed, lean, and hardy, with great curving horns that sometimes measure full five feet from tip to tip.

The entire trend of beef-cattle production in the West has for 25 years been in the direction of "baby beef." The great old-time movement of Southern cattle to the Northwest is rapidly becoming a thing of the past. Southwestern range-bred calves of choice stock are being shipped in increasing numbers into Corn Belt feedlots for a rapid finish to meet the demand for fat, light-weight carcasses. The day of the aged grass-fed bullock has apparently passed forever.

THE COMING OF CATTLE TO THE ATLANTIC SEABOARD

The first important shipment of cattle to New England was in 1624, from Dev-

onshire and adjacent counties, by Governor Edward Winslow, and this was followed up by subsequent importations consigned to "the Governor and Company of Massachusetts Bay." There is record also of the introduction into New Hampshire of some large yellow cattle from Denmark by Captain John Mason, and it is stated that 100 head of oxen of this type were driven into Boston in 1638, where they were sold for £25 per head.

The Connecticut River valley seems early to have attracted attention as a favorable field for stock-breeding, and it was near Springfield, Massachusetts, that William Pynchon, "the first American packer," began, about 1655, as a drover,



Photograph by Crété

A FRENCH OX TEAM THRESHING MACHINE

to take his cattle to the Boston market; by 1670 he was forwarding winter-fed bullocks.

STALL FEEDING BEGAN WITH PYNCHON

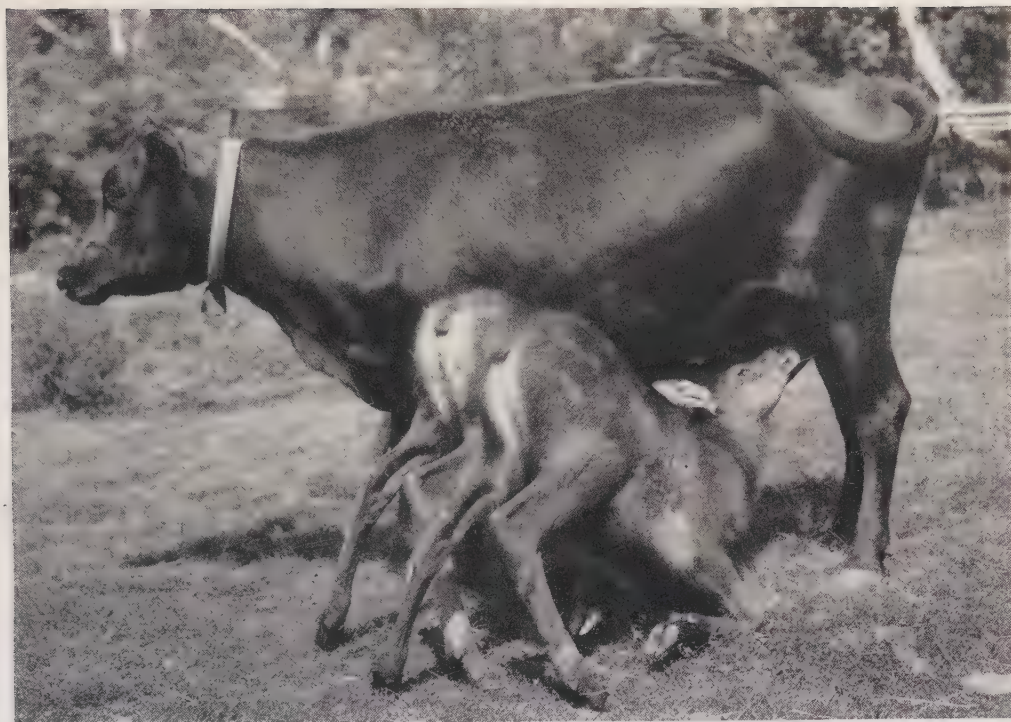
Stall feeding, it is believed, originated in America with Pynchon's operations. The original market place in Boston was the spot where the State House now stands, but in 1742 it was removed to Faneuil Hall. During the American Revolution an extraordinary bullock, weighing 2,270 pounds, is supposed to have "furnished a dinner for General Washington and all the officers of the army at Valley Forge."

The Dutch brought Holland cattle into New Amsterdam and grazed them for slaughtering purposes. Prior to 1676 the killing was done in the city, below Wall Street, and on the Brooklyn shore. By 1694 some 4,000 head were being slaughtered per year.

In Pennsylvania the cattle industry was firmly established prior to the War of Independence, and Philadelphia became the leading seaboard market. Both Quakers and Germans took kindly to cattle feeding, and a lucrative trade with the West Indies was developed.

In 1783 Messrs. Goff & Miller made an importation of Teeswater (Shorthorn) cattle into Virginia that laid the foundations in the valley of the South Branch of the Potomac River for the great business of making beef from Indian corn and blue grass in the United States. Descendants of these cattle accompanied the great emigration from the Old Dominion over the Blue Ridge into the rich pastures of the Ohio Valley, and it was not long before well-fatted droves of fine bullocks were being driven across the mountains to the Baltimore and Philadelphia markets, returning handsome profits to pioneers of Kentucky and southern Ohio.

In 1817 Colonel Lewis Sanders, of Kentucky, observing in an English agricultural newspaper that a bull called "Comet," of Shorthorn production, had been regarded as so valuable as to command at auction the then great sum of 1,000 guineas, placed an order for an importation of cattle to be chosen from the best herds of that day in the Teeswater Valley. These arrived and proved prolific, their descendants providing much of the material in later years for an extraordinary expansion in cattle breeding throughout the Middle West.



© Asahel Curtis

A FOSTER MOTHER TO ELK CALVES IN THE OLYMPIC MOUNTAIN REGION,
WASHINGTON STATE

Kentuckians⁴ migrating into Indiana, Illinois, and Missouri took bulls of this blood into the heart of the Corn Belt.

Subsequent valuable importations into New York included those of Mr. Cox, of Rensselaer County; Samuel Hopkins, into the Genesee Valley, Major General Stephen Van Rensselaer, of Albany, and Charles H. Hall, a New York City merchant. Additional shipments into Massachusetts were those of Samuel Williams, a merchant then residing in London, who sent valuable breeding animals to his brother at Northboro, and Cornelius Coolidge, of Boston, who brought out cattle, the descendants of which were afterward sought in many States.

Colonel John Hare Powel, of Powelton, near Philadelphia, imported between the years 1822 and 1831 a large number of valuable Shorthorns that exerted far-reaching influence in later years among the herds of Pennsylvania, Ohio, and Kentucky.

An organization of southern Ohio farmers sent one of their own members, Felix Renick, to England in 1834 to bring out

more breeding stock, and many valuable animals were safely transferred from Yorkshire to American pastures, proving a mine of wealth to the farmers of that period. Similar coöperative organizations of farmers were formed during the succeeding quarter century in Ohio and Kentucky, and large numbers of still better cattle were by this means made available in the central valleys of the Middle West.

It is interesting to note how perfectly all the various improved breeds now fit into their respective spheres. The place of the Shorthorn in bovine history is clearly defined. Outside of continental Europe it has rendered unequalled primary service in both North and South America. Its particular mission seems to have been the blazing of the trail for other types possessing outstanding adaptations to particular uses—beef-making as a business or dairying as a specialty.

There will always be scrub cattle found in the great spaces not suited to either intensive feeding for prime beef or for



Photograph by Charles J. Belden

ALL ABOARD FOR THE STOCKYARDS

Cowboys are loading range cattle onto the "livestock pullmans" that will carry them to the stockyards, where in short order they are converted into dressed beef.

highly organized dairying, and in that fact is found the perennial demand for the dual-purpose breeds. Under European conditions this field is occupied by such Continental types as the Normandys, Simmentals, Friesians, and various grades and crosses seen in Belgium, Germany, the Danubian regions, and northern Italy.

ADVENT OF GREAT DAIRY BREEDS

The Holstein-Friesians, Jerseys, Guernseys, Ayrshires, Brown Swiss, Devons, and Red Polls are now conspicuous in every leading dairy State. Thousands of these have been transferred during the past four decades from Old World pastures to American farms, to the vast betterment of the national supply of dairy products.

The Department of Agriculture reports that in 1923 some 25,000,000 dairy cows converted various forage crops consumed into \$2,500,000,000 at the farm! Not only that, but the manufacturing of butter,

cheese, condensed milk, milk powder, and ice cream, together with the pasteurization and distribution of fluid milk for city consumption, added at least \$1,500,000,000 more to the retail market value of the dairy cow's contribution to the country's total wealth.

The farm value of dairy products is reported as equaling the combined values of the cotton, wheat, and potatoes grown that same year! And the dairy cow's popularity grows apace.

"THERMOS-BOTTLE" CARS

In the rehabilitation of Northwestern agriculture, now in progress, the claims of the milk breeds are finding widespread recognition, and the demand from that quarter is greater than the available supply of proved profit-producing cows. Friends of the industry find in that fact cause for some concern. Here, as in all other lines of animal husbandry, it is of first importance that foundation stock be

sound in body and efficient converters of foodstuffs into cash.

The recent perfection of that giant "thermos bottle," the glass-lined tank placed on automobile trucks, and later in still larger sizes in railroad trains, is introducing a new influence tending to redistribute the source of milk and cream supply for cities, lessening the advantage of the near-by product, with a growing tendency to equalize the difference in price between the so-called fluid milk territory and the more distant factory territory.

The great majority of the dairy cows in America are in the northeastern quarter of the nation. While the center of human population is in southwestern Indiana, the center of cow population is considerably east and north of this point. The greatest dairy development has followed that section of the country just north of the winter wheat area, lapping over into the northern edge of the Corn Belt area, where early frost frequently overtakes the corn crop.

A national survey of the cow population at the close of the World War disclosed that cows kept to supply cities with milk are owned in the territory tributary by rail to great centers of population, while those supplying the cheese factories, creameries, condensers, and milk-powder plants are located in the great central and northwestern parts of the United States and increasingly in all States.

The leading States in cow population, according to the latest census, are, in round figures: Wisconsin, 1,800,000; New York, 1,500,000; Minnesota, 1,200,000; Illinois, nearly 1,000,000; Iowa, 900,000; Ohio, just a few less, with Pennsylvania, Texas, and Michigan closely following.

PROMOTING AN ESSENTIAL INDUSTRY

The United States Government, through the Bureau of Animal Industry, safeguards the health of our herds, not only by the enforcement of restrictive or exclusion orders against the introduction of cattle from countries where contagious diseases are known to prevail, but maintains a rigid inspection of packing-house operations, and copes energetically and efficiently with all outbreaks of virulent communicable bovine plagues.

The formation of boys' and girls' calf clubs in the various States has gone forward vigorously in recent years, and with far-reaching results in spreading the gospel of the value of good blood. The rising generations of the farm are everywhere vying with each other in keen contests, under expert guidance, as to who can obtain the best results.

The practice of selling surplus pure-bred pedigree stock or dispersing entire herds by resort to auction sales has become an established procedure, and such events attract the attention of all who are desirous of acquiring breeding animals upon the basis of honestly conducted public appraisal.

THE END OF THE TRAIL

The object of all breeders and owners of well-bred cattle is the banishment of the unimproved, unprofitable scrub that is everywhere in evidence.

In coping with the problems of farming in our country, increasing attention must be devoted everywhere to well-bred cattle. They are not, as many erroneously imagine, mere "playthings" for wealthy owners of landed estates.

Those who maintain fine herds mainly for the pleasure they derive from the interesting pursuit of animal breeding are rendering the country a most substantial service, for the herds thus maintained are really our most important nurseries of seed stock, which ultimately finds its way into the fertile fields of everyday, practical/farm operations.

Improved breeds, as already shown, are in the highest degree artificial, as compared with their remote progenitors, and if, through lapse of interest in their perpetuation, they were to be thrown back upon their own resources, they would either perish outright or revert, within a small fraction of the time it has taken to bring about their evolution, to unimproved ancestral types.

An intelligent individual interest in their continued maintenance is, therefore, the patriotic duty of every citizen, whether directly concerned with agricultural prosperity or engaged in other occupations, all of which, at bottom, find support in the well-being of those who live upon the land.

THE GAUR (*Bos gaurus*)

(For illustration, see Color Plate I)

Bos gaurus is the scientific name generally given to the most magnificent of the wild oxen of the tropical East, although there are probably two or three different species or varieties. In India it is commonly, though erroneously, called the Indian Bison. In Indo-China and the Malay States the name of Seladang (Saladang, Sladang) is often applied to these wild cattle. Sometimes they are referred to as the Aurochs, probably because of their extraordinary size and a supposed general resemblance to the so-called Aurochs (*Bos taurus primigenius*) of ancient Europe.

In view of the confusion that has arisen through the interchanging of the terms Urus, Aurochs and *Bos (taurus) primigenius*, it may be well in passing to state that there once existed in the Hercynian and Sarmatian forests what is supposed to have been the largest and fiercest of all quadrupeds indigenous to Europe proper—the wild *Bison Europæus*. There also existed another large animal distinctly not of the Bison group, but of *Bos taurus* classification, known to the Greek and Roman writers as the Urus (see, also, text, page 645). This animal was termed by the ancient Teutons Urochs, or Aurochs, the word being derived from *Ur* (a root found in many languages, and signifying original or old) and *ochs*, an ox.

The Greeks either borrowed the word Urus from the Germans or derived it from the same root *Ur*, used in the composition of their own word *taurus*.

In the course of time the error of confounding the European Bison with the Urus became so common that Pliny and Solinus both pointedly corrected it. Laurentius likewise says: "In Lithuania there are Bisons, Uri, and Elks; those are in error who call the Bisons Uri; for the Bisons differ from the Uri which have the form of an ox, in having manes and long hairs about the neck, in having a beard hanging from the chin and in smelling of musk."

In the Middle Ages Albertus Magnus and others fell into the error of confounding these animals, and several German writers applied the term Urochs or Aurochs, the real designation of their own Urus, to the Bison. Certain modern naturalists seem to have fallen into the same error. This being the case, it is obvious that the employment of the word Aurochs in any discussion of the ancient wild bovine types, not only of Europe but of Western Asia, is not in the line of accuracy from scientific standpoints. The expressions *Bos urus* and *Bos (taurus) primigenius* are interchangeable, and are not susceptible of misinterpretation.

The Gaur bulls often stand six feet high at the shoulder, and a few considerably taller ones have been reported. The males are of massive build, reaching a much larger size than any other species of the Bovidae. The females are in all proportions considerably smaller than the males.

The long, upstanding spines of the vertebrae produce an outstanding ridge above the shoul-

ders. The dewlap is small and inconspicuous, while the ears are proportionately large and noticeable. The tail is relatively short, the tufted end hanging scarcely to the hocks.

The horns of the bulls are massive and heavy, reaching a length of 30 to 39 inches, with basal circumferences of 15 to 20 inches, and are yellowish or greenish in color, with black tips, upward curving and decidedly flattened at their bases.

There is a "high convex ridge on the forehead between the horns," which extends forward, making the upper part of the face bulge out, thus causing the profile to give the impression of a dish-face.

As the bulls reach old age their color becomes dark brown to black, the crown of the head remaining gray. The lower part of the legs is entirely white, and for this reason they have been referred to as the "white-booted cattle."

Gaur cows are lighter in color than the males and are reported in some cases to show a tendency toward redness. It has been noted that the calves have a brown or dark stripe extending along the median dorsal region.

Sports writers grow more enthusiastic over the Gaur than over almost any other animal. They have a stately and magnificent carriage. "The enormous size of the bulls, their fine proportions, noble head, grand incurving, olive-green, black-tipped horns, blue eyes, and the short, sleek olive or blackish-brown coat of both sexes, all combine to render it the superb and peerless member of the ox tribe." Although he considers it a very fine animal, Mr. Kermit Roosevelt, who has recently hunted the Gaur in Mysore, is not sure that he would give it precedence over the African Buffalo.

In small herds, the Gaur ranges throughout all the larger forested parts of India, up into the lower reaches of the Himalayas, into the higher regions of Assam and Burma, throughout the northern parts of the Malay Peninsula, and over into Indo-China. It is not found in Ceylon.

While roaming widely, the Gaur holds to the brush or jungle, and has the reputation of being the most alert and cunning of all the animals of the chase. The bulls are not pugnacious unless wounded or brought to bay, when they become most dangerous and formidable. They are even reported to have met the tiger in close matches.

Only a few Gaur have ever been reported as domesticated, and these only partially so by the semiwild hill tribes in eastern India, where they associate with the Gayal (*Bos frontalis*), which has long been more or less domesticated. In fact, the Gayal and Gaur are closely related and were formerly classed as belonging to the same species.

In the Malay Peninsula the Gaur (Seladang) is classed by naturalists as the variety *B. gaurus hubbacki*. There they resemble the Gayal as much as they do the Indian Gaur. Since it is known that captive Indian Gaur cross with the Gayal in the hills of eastern India, it is not unlikely that there are all kinds of connecting varieties, hybrid for various characters, between the two. The Burmese Gaur (*B. gaurus readi*)



Copyright National Geographic Society

Painting by Edward Herbert Miner

GAUR (*Bos gaurus*), THE NATIVE WILD OX OF EAST INDIA

is also most likely a hybrid complex between the Gaur and the Gayal or some other group with which it crossbreeds.

It must be kept in mind that few, if any, of the species or races of cattle are sharply delimited, as they have wide ranges of crossbreeding. In fact, it appears that there are very few species or breeds of cattle that do not crossbreed with most others.

THE BANTENG (*Bos (Bibos) sondaicus*)

(For illustration, see Color Plate II)

The Banteng, or Banting, sometimes called Sapiutan, inhabits Java, Borneo, the Sunda Islands, the Straits Settlements, and southern Burma, where it is known as the Tsaine, or H'saine (*B. sondaicus birmanicus*). Its range also extends into India on the west and into Indo-China on the east. It is distinguished by a conspicuous white rump, and the lower legs are white below the hocks. The bulls are black, except that the Tsaine in Burma is rufous fawn. The cows and young are rufous, the calves having a brown stripe along the back.

There are many tame Banteng, and in the Lesser Sunda Islands they are reared in considerable numbers and exported to Singapore, where they furnish the principal beef supply.

The Banteng is frequently referred to as a local race of the Gaur of India (see page 638). It is somewhat smaller and the head is long and more slender. The horns are less angular and sharper and the dorsal ridge is not so prominent. The Banteng has a large dewlap, as contrasted with that of the Gaur. It sometimes reaches a height, at the shoulders, of five feet. One specimen was reported as being five feet nine inches high at the withers. The tail hangs considerably below the hocks.

In addition to other resemblances, the calves of the Banteng have almost the same kind of dark-brown stripes down the back as do the young of the Gaur. In eastern India, where it is commonly domesticated by the semiwild hill tribes, the Gayal crossbreeds with the Gaur and the Banteng. As a matter of fact, the three are very closely related and, with their several varieties, make an almost continuous series with the Zebu, or Brahman (*Bos indicus*), on the one end and the extinct Aurochs (*Bos taurus primigenius*) on the other.

According to Rütimeyer, as interpreted by Lydekker, the Zebu was derived from an Indo-Malay group of cattle and most probably from the Banteng itself.

Much confusion exists in many accounts as to whether the Banteng belongs to the Gaur or the Gayal group. It has comparatively longer legs than the Gaur and is, therefore, less likely to climb over rocks and up steep hills, being more restricted to the plains. The domesticated Banteng breeds freely with the Zebu.

THE YAK (*Bos (Poëphagus) grunniens*)

(For illustration, see Color Plate III)

The wild Yak, indigenous to the highlands of central Asia, belongs to the Bisontine group of the Bovine creation, and in common with other

Bisons his voice resembles the grunting of swine; hence naturalists have fastened upon him the designation *Bos* or *Poëphagus grunniens*. In his wild state his habitat was chiefly the high mountains separating India from ancient Tartary.

In his domesticated state the Yak is regarded as a cross between the wild Yak and some bovine type of Taurine derivation. There is a well-recognized relationship between the Gaur, the great wild ox of Asia, the Yak, such East Indian humped Bibovines as the Gayal and Banteng, the various Buffaloes, the Bison, and cattle proper.

Herds of wild Yak have occasionally been found at altitudes of more than 16,000 feet in the Himalayan heights. The domesticated variety is the trusty servant, not only of the Tibetans, but of tribes inhabiting Kashmir and Mongolia, being valued as a beast of burden as well as for its rich, yellow milk. The skin is often used for clothing among the Tibetans.

Its extraordinary growth of hair—a legacy of a hardy, high, snow-covered-mountain-ranging ancestry—is perhaps the Yak's most distinguishing characteristic. It grows so luxuriantly over the shoulders as sometimes to be mistaken for a hump. Rugs and strong cloth are woven from it, and the long-flowing tail is put to various uses, as, for instance, the "chowries" or fly-flaps of India.

A most interesting experiment is being carried on by the Department of Agriculture of the Canadian Government in crossing the Yak upon domesticated cattle. Hybrids partaking of certain characteristics of both parents are now coming to maturity and will be subjected to further crossing. This experiment was suggested by the successful mating of Bison bulls with domestic cattle, as carried out in Kansas some years ago—the progeny being called "Catalo."

BRAHMAN (ZEBU) CATTLE (*Bos indicus*)

(For illustration, see Color Plate IV)

Over much of Asia and Africa is found a type of cattle presenting certain marked differences from the cattle of America and Europe. These differences are characterized by a fleshy hump above the shoulders, an extreme development of loose skin along the entire underside of the neck, and a similar pendent condition of skin about the navel, more especially marked in the males; a short, steep rump and comparatively long legs.

The head is long and narrow, from the sleepy-appearing eyes to the muzzle; the ears are very long and often are carried in a drooping manner; the horns differ widely, according to sex and breed, but with the males they are usually very large and long. The color of the hair, which is short and fine, ranges through various shades of gray to brown. The hoofs are black and the skin color ranges from brown to black, according to breed.

These humped cattle have long been known in Europe under the name of Zebu, although, according to Lydekker, how the word originated

and by whom it was first employed in literature have not yet been determined.

The native home of these cattle has been assumed to be India, and there they are kept in large numbers, where they are used as beasts of burden and for meat and milk. White bulls of the breed are regarded as sacred by the Brahman caste of India, being associated with their Hindu divinity, Brahma.

There are many different breeds of these cattle in Asia and Africa. They vary in size, development of hump and pendent skin, form and size of horn, and color. These breeds derive their names from the localities in which they have been bred and developed. However, they do not show the careful breeding characteristic of the improved breeds of America and Europe.

The Zebu of India has been introduced into the United States under the name of Brahman, which has been officially adopted as the preferred form by the United States Department of Agriculture.

The Brahman cattle have long been familiar at circuses and in zoological gardens, but the first recorded importation to America was that of Dr. J. B. Davis, of South Carolina, in 1849. Following this, from time to time small importations were made to the south and southwestern United States. In 1906 A. P. Borden imported 51 head from India to the Pierce Estate, in Wharton County, Texas. During the last quarter of a century especially, Brahman cattle have been crossed in a limited degree on other cattle in certain herds along the Gulf coast of Louisiana and Texas. Through crossing, the hump has been more or less removed and the value of the crossbred carcass for beef is much improved over the parent Brahman stock.

Advocates of these cattle and their crosses in the United States especially emphasize their freedom from ticks and southern fever and their ability to withstand heat and drouth in a very hot climate. A Brahman Cattle Breeders' Association was organized in Texas in March, 1924.

PODOLIAN CATTLE

In a district of southwestern Russia known as Podolia (Podolsk), and in Hungary, we find a breed of cattle known by the name of Podolian. In Hungary it is also termed the Gray or White Hungarian. It has been assumed that these animals are descended from the Giant Ox, *Bos taurus primigenius*. In 1903 Professor Charles Monostori, of the Royal Hungarian Veterinary School at Budapest, wrote in *The Breeder's Gazette* that the breed was 1,000 years old and was extensively bred in Hungary.

The following are the essential features of the breed: The typical animal is large of frame, lean and robust, narrow-chested, heavy of dewlap, and long of leg. The color is a light or dark gray. The horns are the longest among existing breeds of cattle.

Mature cows stand about 56 inches high at the shoulders, and bulls at 60 inches, the former weighing about 1,200 pounds and the latter 1,850 pounds. The Podolian is naturally very active

of foot, and hence is most highly regarded for draft purposes.

In milk production the breed ranks as very inferior, although a number of breeders have brought marked improvement in this respect, and cows have been known to produce in a year 2,000 quarts of milk testing 2.6 per cent fat. These cattle are extremely healthy and epidemic or contagious maladies among them are not known to have occurred.

Lydekker states that this breed, which ranges through Hungary into Turkey and southwestern Asia, is represented by two strains, one characteristic of Hungary and the other of Transylvania. In both types the bulls have the general pale-drab color of the short coat, relieved by black markings on the muzzle, dewlap, and certain other parts of the head and body, and the black tail tuft, while the lower portions of the legs show more or less white.

The horns of the bulls, which are beautifully shaped and symmetrical, are long and somewhat doubly curved, with an outward, upward, and finally backward direction; they are black toward the tips, but elsewhere grayish white. Those of the cows are much more slender, with a more pronounced backward inclination at the tips. Longest of all are those of oxen, which may measure fully five feet from tip to tip.

The bulls of the Hungarian strain are heavier animals, with a fuller dewlap than those of Transylvania.

In Italy, especially in the district about Rome, one will see large, silver-gray cattle, with great horns, muscular and lean of flesh, commonly used for draft purposes. These are known as Roman or Campagna cattle, and, although bred for many centuries in that country, they are no doubt closely related to the Podolian.

THE INDIAN (WATER) BUFFALO (*Bos bubalus*)

(For illustration, see Color Plate V)

In the wild Indian (Water) Buffalo, from which the domesticated Buffaloes are supposed to be descendants, the male is distinguished by a greater proportionate length of the head, the profile of which is nearly straight. The center of the forehead is distinctly convex. The sockets of the eyes in the skull are very large and the nasal bones are of considerable length. The ears are comparatively small, with relatively small openings, and the fringe of hair on their edges is thin.

The long, triangular, flattened, transversely wrinkled horns are very prominent. "They taper gradually from root to tip and generally curve regularly upward, outward, and a little backward from the line of the face in nearly a single plane, the tips bending inward and slightly forward" (Lydekker). There is another type in which the horns extend directly outward and turn up only near the tips. The horns of the cows are relatively longer and thinner and not so strikingly triangular as those of the males, and they point more straightly outward.

The color of both sexes is black or ashy,



Copyright National Geographic Society

Painting by Edward Herbert Miner

BANTENG (*Bos sondaicus*), THE NATIVE WILD OX OF THE MALAY PENINSULA

THE CATTLE OF THE WORLD



Copyright National Geographic Society

Painting from life by Edward Herbert Miner

YAK (*Bos grunniens*), THE NATIVE WILD OX OF TIBET

and below the hocks they may be light gray to white. Some individuals are nearly dun, probably due to an admixture of a dun-colored variety from northern Assam. They never have a thick coating of hair and the old animals become almost bare.

The males are reported to reach a shoulder height ranging from five to six feet, though one experienced hunter, General Kinloch, doubts if they ever reach a height greater than five feet four inches (sixteen hands). One individual, which was five feet in height from the shoulders, had a length of nine feet seven inches from the nose to the root of the tail, the tail measuring three feet eleven inches, and the girth of the body was eight feet three inches.

The true wild Indian Buffalo is found mainly in the neighborhood of swamps, in tall-grass jungles. It is not found in a truly wild state in any other country than India. It inhabits the plains near the Ganges and Brahmaputra and up into the foothills of the Himalayas, and occurs near the coast in Midnapore and Orissa, and in the eastern portions of the Central Provinces, and in northern Ceylon.

The herds found running wild in Burma and in the Straits Settlements are supposed to have descended from animals that escaped from captivity. The Buffalo is not now found in the real wild state west of the Indus, but in the pre-Christian Era it appears to have ranged over into Mesopotamia, according to Durst. However, even if the Buffaloes of Egypt and northern Africa did originate from the wild Indian form, they may not have been derived from the ancient Babylonian wild Buffalo, but from later importations of domesticated breeds from India.

About the same degree of obscurity shrouds the origin and distribution of the various breeds of Buffaloes in Asia and Europe as that which conceals the beginnings of domesticated animals in general. Even in India there are at present many more or less well-defined local breeds distinguished by variations in build, size, horns, and other characters. None of these breeds, however, differs from the wild type so much as do the many breeds of Western cattle.

The wild Indian Buffalo is found mainly in the tall-grass jungles, usually where there are swamps, though it may be found in the more open country and occasionally even in the forests. The grass in the normal habitat grows so tall that herds of Buffaloes have tunneled, as it were, through it. The hunter may approach within a few feet of an animal or herd and not get a glimpse.

The Indian Buffalo, according to Lydekker, feeds chiefly on grass, in the evening, at night, and in the morning, and generally lies down in high grass, not infrequently in a marsh, during the day. It is by no means shy, nor does it appear to shun the neighborhood of man, for it commits great havoc among growing crops. Sometimes a herd or a solitary bull will take possession of a field and keep off the men who own it. In fact, Buffaloes are by far the boldest and most savage of the Indian Bovidæ.

Tame as well as wild Buffaloes spend much time in the water. It is supposed that, because

they do not appear to perspire to any great extent, immersion in water or the frequent wetting of the skin functions in regulating the heat of the body. However, it is observed that the tame Buffaloes, not only of India, but of all the Orient, are often worked for long hours in the heat and without a bath.

Water Buffaloes are widely distributed in Asia and Europe, are used as beasts of burden, and furnish both meat and milk.

CATALO

The word Catalo (Cattalo) appears to have been first proposed by C. J. (Buffalo) Jones, who was born in Bloomington, Indiana, in 1844 and died in Topeka, Kansas, in 1919. "The new animal I called the Catalo," he says, "cat for the first letters of cattle and alo, the last letters of buffalo." This is the way it is frequently spelled in the dictionaries, though Colonel Charles Goodnight and some writers have used two t's, making it Cattalo (sometimes Cattalow). The term is usually applied to any of the grades as long as they trace back, however remotely, to the Buffalo.

The name Catalo appears to be reserved for the hybrid offspring from crosses of the American Bison, or Buffalo (*Bison (Bos) americanus*), on cattle (*Bos taurus*). The very fact that the Bison and cattle cross and produce fertile offspring raises the question as to the propriety of placing the two in separate genera or even separate species. The cross has been made by C. J. Jones, Colonel Charles Goodnight, of Texas; Mossom M. Boyd, of Bobcaygeon, Ontario, Canada, and by the Canadian Government.

It appears that both sexes of first hybrids have resulted from some of the crosses, but Colonel Goodnight has always insisted that male first hybrids have never been born alive in his experiments. It is not due to the hump, or size, but probably to some physiological feature that the male hybrids do not usually survive the period of birth.

Neither Colonel Goodnight nor Buffalo Jones kept dependable records of their experiments. It cannot even be determined, from their statements, who first succeeded in securing a Catalo. Jones began at some time after "having lost two-thirds of my domestic calves by a severe blizzard during the winter of 1885-6." Goodnight's first two hybrids were born in 1888.

It is not improbable that Bison and semiwild cattle had crossed previously. There are anecdotal accounts to the effect that even in Revolutionary times Buffalo-cattle crosses were made. However, on account of the difficulties of mating and the frequency of failure during gestation, it is not likely that extensive crossbreeding occurred.

The crossbreeding of the European Bison (*Bison (Bos) bonasus*) with cattle has been effected in the Halle Zoölogical Gardens, and elsewhere in Germany, and at one of the Russian Government experiment stations in the Crimea.

Great honor is due Colonel Goodnight and Buffalo Jones for their enterprise and sacrifices

in demonstrating the feasibility of such cross-breeding; but it appears that Mr. Mossom M. Boyd, beginning in 1894, carried out and recorded the nearest approach to a scientifically adequate experiment. Lately, Mr. Boyd's stock has been obtained by the Canadian Government.

According to Mr. Boyd, in 102 successful impregnations of cows by Buffaloes, there were 63 abortions and 39 births. Of the 39 births, 6 were males, only two of which survived over 24 hours, and the one that became adult proved sterile.

Mr. Boyd used several breeds of cattle, and he tentatively summed up the dominance, or recessiveness, of the respective characteristics in the first hybrids as follows:

Dominant: whole body color of Buffalo (usually); the white face of the Herefords; the polled head of the Angus; the hump of the Buffalo (modified); width of the hind quarters of the beef breeds; the width in front of the beef breeds; the hair or fur in length and quality (intermediate); the voice of the Buffalo. The hybrids do not become bare by shedding hair, as in the case of the Buffalo.

Of 10 hybrids examined, 9 had the 13 ribs of cattle and one 14, like the Buffalo (this one died early). The first hybrids are superior as beef animals, becoming very large and cutting large portions of the choicest meats.

As potent hybrid males are not born, further breeding of the hybrids begins by breeding back to either Buffalo or cattle males. There is considerable infertility among the hybrid cows and they produce comparatively few potent males. However, after two or more crosses back either way, the matter of the sexes appears to even up.

However difficult the work and slow the progress, Buffalo characteristics are now scattered far and wide in the herds all over North America and even in Europe. It is entirely probable that successful breeds of the future will owe some of their success to these characteristics. That this has been the method, to a large extent, by which breeds of domesticated animals have been developed is altogether likely.

WILD WHITE (OR PARK) CATTLE

(For illustration, see Color Plate VI)

The ancestry of our improved breeds of cattle, such as one commonly sees in North America and Europe, has been attributed to several different sources. Important remains of two types that existed in prehistoric times have been found in considerable numbers in England and Scotland. One type, termed the Urus, or Giant Ox (*Bos taurus primigenius*), that stood about six feet high at the shoulders, existed in the early Stone Age, while a much smaller form, *Bos longifrons*, frequently referred to as the Celtic Ox, existed in the late Stone Age and was intimately associated with primitive man.

The remains of *Bos longifrons* have usually been found associated with human habitations, indicating domestication, even as late as the Roman occupation of Britain. Skulls of these cattle have been found in which were embedded stone celts or spearheads.

The nearest connecting link we have with these prehistoric forms are the Wild White, or Park, Cattle, as they are now coming to be known. Some authorities regard them as descendants of the Urus, while others consider them more directly related to *Bos longifrons*. The theory has also been advanced that they may be descended from cattle brought from southern Europe by the Romans and left to shift for themselves when the invaders were driven from England.

For centuries herds of Wild White Cattle have occupied certain parks and forest areas in England and southern Scotland. Hector Boece in 1527 wrote that in the great Caledonian wood there were bulls of the purest white, and that "they wer mair wild than ony uthir beistes."

There are at the present time five herds of Wild White Cattle descended from the original type that roamed in the primeval forests of Great Britain, as follows: At Chillingham Park, in Northumberland, and at Chartley Park, in Staffordshire; Cadzow Park, in Lanarkshire; in North Wales, at Vaynol Park, near Bangor, and at Lamphrey Court, in South Wales.

The Wild White Cattle are generally small, the dead weight of bulls at maturity being 500 to 600 pounds. While the general color of the hair is white, J. Storer, in his standard work on this breed, states that in all the herds the tips of the horns, the muzzle, the circle around the eyes, and the hoofs are black. The ears are either black or brownish red inside and more or less of the same color on the outside. Sometimes small dark spots occur about the neck and over the ankles.

In general form this is a beef type, but the quarters are thin and muscular. The coat is long and shaggy, and especially so over the top of the head and neck of the bull. Its disposition is distinctly wild where uncrossed with domestic cattle, and it quickly retires at the approach of man and seeks more inaccessible parts of its park home. While most of the known herds of these cattle have been horned, polled herds have also existed.

The most notable of the herds of Wild White Cattle is that of the Earl of Tankerville at Chillingham. It became famous through Sir Edwin Landseer, whose painting, "The Wild White Cattle of Chillingham," is one of his masterpieces.

This herd is kept in a park of about 1,100 acres, where for a long time the cattle have reproduced without the supervision of man. In 1919 the herd numbered 56 head. Some experimental work was begun here in 1875, crossing wild cows with purebred white Shorthorns, which resulted in cattle producing very superior beef. A line of crossing was continued whereby the fifth-generation cows descended from the Wild-Shorthorn cross were registered in Coates' Herd Book as Shorthorns.

A Park Cattle Society was organized in England a few years ago to preserve existing herds and to promote their purity. In 1919 the society published the first volume of a Park Cattle Society Herd Book.



Painting from life by Edward Herbert Miner

BRAHMANS (ZEBUS) (*Bos indicus*), NATIVES OF INDIA

Copyright National Geographic Society



Copyright National Geographic Society

WATER BUFFALO (*Bos bubalus*), A NATIVE OF INDIA

Painting from life by Edward Herbert Miner

THE SHORTHORN

(For illustration, see Color Plate VII)

Standing at the head of all dual-purpose breeds, in point of distribution, is the Shorthorn, an English type originated in the counties of York and Durham, in the valley of the River Tees and contiguous territory; hence one of its early designations as the "Teeswater breed."

The Shorthorn may be solid red, red with white markings, white or roan; in fact, it is often referred to as "the red, white, and roan." Aside from its old-time competitor, the English Longhorn, which it long ago eclipsed in popularity, the Shorthorn is the only breed that throws the roan color, a fine intermingling of the individual red and white hairs.

The roan varies in shade from what is called red-roan to very light roans, verging on pure white. A roan coat, therefore, is as distinctive an index of the presence of Shorthorn blood as the white face is commonly indicative of a Hereford cross.

At one time in America the Shorthorn color most sought was the solid red. During that period white bulls were simply unsalable and the roans were discriminated against. This grew out of the fact that western ranchmen disliked the light colors for their particular purposes, and as the demand for Shorthorn bulls from the range was one of the mainstays of the trade, breeders naturally responded by maintaining red bulls in service in the pedigree herds from which the range country originally drew its supplies of breeding bulls.

This was a distinct disadvantage to the breed, as it limited the selection of sires at a time when recourse to all the best material within the breed was most required. Fortunately, in the old country the Scotch and English breeders were not subject to any such pressure and continued to utilize the roans and whites. At the present time the lighter colors have come back into their original popularity, and even the pure-white bulls are freely used in the most valuable collections, if possessed of outstanding merit.

In the early days of the introduction of the breed into the United States it was frequently called "Durham," after one of the two ancestral English counties, and it is to be regretted that this name did not meet with universal adoption. The appellation that finally obtained official sanction at home and abroad was originally given by way of differentiating the type sharply from the then widely distributed Longhorns of the Midland and western English shires.

The improved Shorthorn dates from the early years of the nineteenth century. A large but somewhat coarse race of cattle, possessing an extraordinary capacity to put on flesh under heavy feeding, and also noted for its milk-giving propensity, had for generations existed in Northumberland, Yorkshire, and the Tees River Valley. It was sometimes referred to as the "Holderness" breed, but that designation at length was supplanted by the general term "Teeswater stock," and subsequently by the name which the breed now bears.

At Darlington, Durham, Yarm, and other central points, market fairs, the forerunners of

our modern shows, attracted all the progressive farmers and feeders of the countryside. The best specimens of the breed at that time were "generally wide-backed, well-framed cows, deep in their fore quarters, soft and mellow in their hair and 'handling,' and possessing, with average milking qualities, a remarkable disposition to fatten."

About three miles northeast of Darlington, in the County of Durham, overlooking a little stream that flows into the Tees at Croft, is the farm of Brampton, and about a mile beyond is Ketton. Upon these two farms the modern Shorthorn may be said to have had its origin.

Charles Colling had heard of Bakewell and his work, and in 1783 made a prolonged study at Dishley of the theory and practice of "close" breeding. In June of the following year he bought in Darlington market a cow, which he named Duchess, that gave rise to the family of that name, and which afterward became the subject of one of the wildest cattle speculations known in all the annals of English or American agriculture.

This primal Duchess was described as "a massive, short-legged animal of a beautiful yellow-red flecked color; her breast was near the ground and her back wide."

Robert Colling's selection of the bull called Hubback, distinguished for his fine finish and mellow-handling quality, marked the turning point from the old- to the new-type Shorthorn. It was with the blood of this bull that the Collings began their successful application of the Bakewell system, the issue of a doubly incestuous union being the bull Comet (155), the pride of his time, and the first Shorthorn to sell for \$5,000.

The importation of this blood to America began in 1783, some years prior to the Colling improvement, at which date Messrs. Goff & Miller brought out specimens of the old Teeswater type to Virginia, the descendants of which, under the name of the "Patton stock," taken into Kentucky around 1800, laid the foundation of the Midwest cattle-feeding industry.

Other importations, as detailed elsewhere in this text, followed into New York, New England, and Kentucky, but it was not until after the full measure of the improvement made in England by the contemporaries and successors of the Collings had been realized that the breed obtained that widespread popularity in America that set in with the notable importations made between 1820 and 1860.

The leading spirits in Yorkshire in the making of the modern Shorthorn were Thomas Bates and the Booths, the former relying largely upon the blood of the Duchess tribe, derived from the cow of that name already mentioned.

Mr. Bates is generally conceded to have been one of the greatest cattle breeders of his own or any time. He sought refinement of conformation and milking capacity, combined with fleshing tendencies, and resorted to inbreeding to accomplish his purposes. So successful was he that for years after the dispersion of his herd, in 1850, cattle of "Bates" breeding were in demand on both sides of the Atlantic at ex-

traordinary prices. The culmination of a contest between English and American breeders was reached at the sale of the celebrated New York Mills herd at Utica, New York, in 1873, where a top price of \$40,600 was offered for a single cow of the Duchess tribe.

The Booths, on the other hand, stressed the beef-making tendencies rather than dairy capacity, and were equally successful in that direction, their cattle being distinguished for shortness of leg and exceptional wealth of flesh. The achievements of these and other leading English breeders of their time were so phenomenal that the name and fame of the Shorthorn breed spread rapidly throughout the entire English-speaking world. In fact, up to around 1870, no other modern breed of cattle had any wide dissemination in the United States.

In the late seventies and early eighties the expansion of the beef-making business in the West turned the efforts of Shorthorn breeders toward a purely beef type, which resulted in a general recourse to the blood of cattle of a low-legged, deep-fleshed type that had been developed in Scotland.

In Aberdeenshire two brothers, Anthony and Amos Cruickshank, practically did for the Shorthorn at this period what the Colling brothers had accomplished in their day. Farming in a district not endowed by Nature with such favorable conditions in respect to grass, soil, and climate as those obtaining in the ancestral home of the breed, these canny Scots, disregarding more or less the dairy side of the business, set out to evolve a type that would be well adapted to making beef rapidly and economically from turnips, straw, and such grazing as the stony North Country afforded.

The story of how Amos Cruickshank slowly but surely accomplished this purpose has few parallels in this field. After years of careful selections from various English and early Scottish herds, there was finally produced at his farm of Sittyton a bull called Champion of England, representing so closely the ideal sought that for a long period of years none but his sons and grandsons were used for stock purposes.

Again the Bakewell system of establishing and "fixing" a type proved its potency, so that before 1880 this Aberdeenshire herd stood out as not only one of the largest, but one of the greatest collections of cattle of an easy-keeping, quick-maturing, dependable type in the bovine kingdom. It was already the fountainhead from which other North British breeders were drawing their herd bulls, and its character had been impressed very generally in Aberdeen and adjacent counties, where Shorthorns were kept in keen competition with the Aberdeen-Angus polls.

It is to this fortuitous circumstance that the breed owed its rejuvenation in America after the advent in the West of the other beef-making British races. Scotch-Canadians had already been drawing upon Aberdeenshire for breeding stock prior to the advent of the Hereford and the "doddies" in the Corn Belt States, and enterprising Middle West Shorthorn breeders,

recognizing the inability of the cattle they had allowed to lose their old-time practical value for breeding purposes to meet the changing condition, were quick to see the opportunity of opposing the rival breeds by recourse to animals of Cruickshank and kindred production.

This revolution in American Shorthorn breeding occurred during the eighties. Great numbers of the Scotch cattle have since been transferred to this side of the Atlantic, and at the present time a large majority of the champions at all leading shows where beef form is the test of excellence are of this blood.

In recent years there has been a widespread movement toward the rehabilitation of the breed on this side of the water along strictly dual-purpose lines. The place of the beef type in the affections of Corn Belt feeders is, apparently, secure; but toward the East and throughout large areas in other sections of the country, where neither feeding for the beef market nor supplying urban centers with dairy products as a specialty is generally practiced, a great development in dual-purpose Shorthorn production is going on. Those who are interested in this are working with selected material of domestic production, reinforced by importations from English herds.

In various parts of England there are choice collections of cattle still showing the time-honored Shorthorn beef-and-milk combination. Cumberland and Westmorland are particularly famous for their big, broad-backed, deep-bodied cows swinging fine udders. It is inevitable that this movement in America will expand, to the manifest advantage of the country.

A number of extraordinary milk and butterfat records, comparing favorably with the best results from strictly dairy-bred cattle, have been made by registered Shorthorn cows in the United States, the highest being that of Dairy-maid, who produced 19,666.5 pounds of milk in twelve months, carrying 669.45 pounds of fat. The records of 2,589 tests officially recorded show an average milk production of 8,444.98 pounds, with an average fat yield of 332.96 pounds.

A world's record for combined milk and butterfat produced in twelve months is held at the present time by the cow Melba 15th of Darbajara, recently reported from New South Wales, Australia, to have produced 32,522 pounds of milk and 1,614 pounds of butterfat.

The American Shorthorn Breeders' Association reports that 2,025,900 head of cattle of this breed had been registered in the Herd Book up to October, 1925. The census of 1920 reported a total of 478,760 head of purebreds in the various States.

In Argentina the Shorthorn is a prime favorite in the operation of the large *estancias*, great numbers of the best and highest-priced animals of the breed in Great Britain having been bought for use in the extensive cattle-breeding operations conducted in the great grazing regions tributary to Buenos Aires. Shipments of American-bred cattle to Argentina have also been numerous in recent years.



Copyright National Geographic Society
THE WILD WHITE (OR PARK) CATTLE OF GREAT BRITAIN, SUPPOSEDLY OF *Bos taurus* ORIGIN:
TO THE LEFT, CHILLINGHAM BULL; RIGHT, CADZOW COW AND CALF
Painting by Edward Herbert Miner



Copyright National Geographic Society

SHORTHORNS, AN IMPROVED BREED OF ENGLISH ORIGIN, VALUABLE BOTH AS DAIRY AND BEEF CATTLE
Painting from life by Edward Herbert Miner

POLLED SHORTHORNS

Polled Shorthorns are just what the name implies—Shorthorns without horns. These cattle do not constitute a distinct breed, but are a strain of the Shorthorn breed, possessing all the color and type characteristics of Shorthorns except the horns. Their origin and development in the United States stand forth as important accomplishments in American cattle breeding.

The history of Polled Shorthorns is interesting, for it shows that back of all animal improvement there has been an economic reason. About the year 1880, when the feeding of cattle in feedlots of the Corn Belt assumed great proportions, it was found that cattle with horns could not easily accommodate themselves to limited space. Shorthorn cattle have always been popular with practical farmers, and it occurred to many farmers in various parts of the Corn Belt that crossing Shorthorns with native hornless cattle would produce the desired type. In 1888 the story of a small herd of naturally hornless, purebred, registered Shorthorns first appeared in *The Breeder's Gazette*. These "sports," or "mutants," were the property of the McNair Estate, near Minneapolis, Minnesota.

Five of these cattle, hornless Shorthorns, including the historic twins, Mollie Gwynne and Nellie Gwynne, were purchased by Captain W. S. Miller, of Ohio, and taken to the Buckeye State, along with their half-brother, King of Kine. These animals, and other natural Polled Shorthorns that were later found, constituted the foundation for our present-day Polled Shorthorns. With these animals it was possible to cross the polled and the horned purebreds, and to register all the progeny in the American Shorthorn Herd Book, where all Polled Shorthorns are now recorded. There was no loss here—the horned animals could be sold for seed stock as Shorthorns; the hornless ones could be sold for foundation stock among fanciers of the Polled Shorthorns.

The late J. H. Miller, of Peru and Mexico, Indiana, is credited with having been the outstanding improver of this strain of Shorthorn cattle. He introduced the best Scotch Shorthorn blood and developed Polled Shorthorns to the correct show-yard and market type. In breeding he worked improvement both through the female side and through the male line.

In 1896 Miller attended the dispersion sale of the famous Shorthorn cattle of the late Senator W. A. Harris, of Kansas, and purchased a carload of the best females in that herd. He took these cows back to Indiana and mated them with his polled bulls. This cross was followed up by the use of the best Shorthorn bulls he could find, including Sultan of Anoka, one of the best sons of Whitehall Sultan, credited with having done more to improve the type of the Polled Shorthorn than any other bull of the breed.

Many good milkers have been developed among the Polled Shorthorns, and many of the cows have qualified for the Record of Merit. In all, there have been more than 38,000 cows and nearly 30,000 bulls of the Polled Shorthorn strain registered. They are most numerous in

the Corn Belt States of Iowa, Nebraska, Illinois, Indiana, Kansas, and Ohio, with South Dakota and Wisconsin ranking next in order.

BROWN SWISS

(For illustration, see Color Plate VIII)

The ancient Helvetians were a pastoral people, and Switzerland is to-day the home of three distinct types of cattle admirably adapted to their Alpine environment—the Schwyz (known in America as Brown Swiss), the Simmentals, and the Fribourg.

The cattle of the lake-dwellers of the Alps, of prehistoric times, receive frequent mention by scientists in connection with discussions of various wild bovine genera. The two mountain chains, the Alps and Jura, cross the country from northeast to southwest, and between Lake Geneva and Lake Constance is a beautiful region of hills and mountains of minor altitudes, the plateau called by the Swiss the Mittelland. These mountain pastures and meadowlands are ideal for cattle-breeding purposes and produce a rugged and yet productive race.

While maintained primarily for dairy purposes, the Swiss cattle are claimed to be a real dual-purpose type. They are heavier-boned than the Channel Island breeds and more inclined to take on flesh.

The original home of the Schwyz was the Canton of that name, but the type is now bred in all the neighboring cantons of the Alpine region. In color they range from dark brown and gray to lighter shades. The heavier specimens are found on the valley farms and the lighter weights in the high mountains. The average weight of matured cows of the heavier type is 1,200 to 1,300 pounds; that of bulls from 1,700 to 1,900 pounds.

Data assembled by the Schwyz Cattle Breeders' Association, based on performance in various herds, indicate milk production in their native land of about 10,000 pounds per year per cow, showing a fat content of about 4 per cent. In exceptional cases these yields are, of course, exceeded.

The Brown Swiss were first introduced into America by Henry M. Clark, of Belmont, Massachusetts, who imported a bull and seven heifers in 1869. It was not until the early eighties, however, that the type came into general notice. In 1882 Messrs. Nelson B. Scott, of Worcester, Massachusetts, and George W. Harris, of Wethersfield, Connecticut, made an importation of 10 head, which were greatly admired and disposed of to breeders in Connecticut. A second lot brought over by the same parties likewise were favorably received. This was followed by a third shipment that found a home in Illinois. In 1889 Enos M. Barton, of Chicago, imported 14 head, which became the nucleus of one of the best herds ever owned in the United States. McLaury Bros., of New York, made an important importation in 1904.

Brown Swiss cows are good and persistent milkers, possessing a large, square udder and well-placed teats, uncommonly free from malformations. The quality of their milk is indi-

cated by a full 4-per cent showing of butterfat. Switzerland is famous for its cheese, and the reputation of the breed in connection with that industry in America is of the best.

The Brown Swiss are of strong constitution, respond generously to liberal feeding, are exceedingly docile in disposition, and retain flesh well, even during periods of heavy lactation.

One of the profits of the dairyman is derived from the sale of veal calves. Those from Swiss cows are well-developed at birth, weighing from 80 to 100 pounds when dropped. They show the compact, blocky conformation so characteristic of the breed, and are, therefore, unexcelled as veal.

Among the high-production records of Brown Swiss cows in America may be cited the case of Hawthorn Dairy Maid, with the breed record at this date of 22,622.6 pounds of milk and 927.23 pounds of butterfat in one year.

Although the Register of Production of the breed in America was started only 10 years ago, 450 cows are already listed on the honor roll. Nearly 400 have qualified in the yearly test, the average of this large number of cows for one year being 11,773.4 pounds of milk and 471.63 pounds of fat. In the 10 months' test 58 cows have an average production of 9,640 pounds of milk and 381.45 pounds of fat. Ten high cows in the mature class of the yearly test have an average production of 800 pounds of butterfat.

All of the cows in the mature class, 156 in number, have an average production of 13,744 pounds of milk and 547.55 pounds of fat. Pretty Jane, the leading five-year-old, has a production of 18,042.5 pounds of milk and 801.42 pounds of fat for 365 days. All of the five-year-olds, 62 in number, that have qualified for the Register of Production have an average production of 519.7 pounds of fat for one year.

This breed finds much favor in central Europe, having long been utilized in Germany, in Austria, and in Hungary as well as in Italy. It is gaining ground in the United States and attracts increasing attention at our national dairy shows, the best specimens showing marked improvement in recent years.

The product of a mountain environment, the Brown Swiss should naturally respond well to the abundant forage of lower altitudes. It should also render a good account of itself in the mountain valleys of our own Western highlands, where dairy goods find an improving market as towns and cities increase in population.

There have been registered up to the present time in the American Herd Book a total of 13,395 bulls and 20,022 cows.

SIMMENTAL

For many centuries the Simmental, the valley of the Simmen River, in the Canton of Berne, Switzerland, with its splendid grazing, has been noted as the home of the type of cattle of that name which still find favor in their native land and in various parts of central Europe.

The Simmental is larger than the Schwyz (or Brown Swiss) breed, cows of the heavier type weighing from 1,400 to 1,600 pounds and

matured bulls up to over 2,000 pounds. In color they are red and white, those in which the red predominates being preferred to the white with red markings. The red varies from a dark cherry to a yellowish shade.

The milk yield of the Simmental does not vary greatly from that of the Brown Swiss, ranging around 10,000 pounds per year per cow, with a fat content of close to 4 per cent.

In the old days the Simmental was extensively used for draft purposes in connection with agricultural operations. A Swiss writer refers to its great value for this purpose in the following language:

"The structure, the constitution and temperament of the cattle of the Simmental breed render them to a high degree apt for work. Strong bones, well-developed muscles of all the parts of the body, especially the back, the pelvis, the shoulders and of the limbs, a strong and elastic skin, a great facility in the movements of the articulations, a quick temperament, good nature, health and strength of resistance, intelligent eyes and docility are the special qualities of the Simmental cattle, and all this renders them apt for labor."

While this breed is virtually unknown in the United States, it has enjoyed much popularity, not only in Switzerland, but in south Germany—particularly in Baden, Württemberg, and Bavaria. They are also seen upon Austrian and Hungarian farms and in northern Italy. In these countries the Simmental bull has crossed to the satisfaction of farmers upon smaller, inferior stocks.

FRIBOURG

The Fribourg is a minor Swiss breed, taking its designation from the Canton of that name. In general character and size it is similar to the Simmental, but differs in color, being black and white. The Swiss prefer the black and white evenly distributed. Sometimes the animals show a white head and legs, with a black body, and again they come nearly all white or quite solidly black, but such coloring is tabu among breeders.

Animals of the Fribourg breed are seen in northern Germany and in parts of Russia; also in Italy and in Danubian territory.

NORMAN TYPES

The ancient Province of Normandy, in northwestern France, comprises nearly 7,000,000 acres, much of which is of superior fertility, where many cattle graze. While its cattle are generally known as Normans, the French classify them into two subraces or breeds—Cotentin and Augeronne. The former derives its name from the Cotentin district, a lowlying section in La Manche extending some distance back from the port of Cherbourg. In the Departments of La Manche and Calvados the breed is kept almost exclusively, but in recent years it has met with favor in other sections of France outside of its native Province.

The Cotentin is a large breed and combines in a marked degree both beef and milk production. The color is usually a combination of



Copyright National Geographic Society

Painting from life by Edward Herbert Miner

BROWN SWISS COW, AN IMPROVED DAIRY TYPE OF ALPINE ORIGIN

THE CATTLE OF THE WORLD



Copyright National Geographic Society

Painting from life by Edward Herbert Miner

DUTCH BELTED COWS, AN IMPROVED DAIRY TYPE OF NETHERLANDS ORIGIN

yellow, red or black forming a brindle, or with white giving a spotted effect. Not infrequently the Cotentin possesses color markings similar to those of the Hereford, which has brought forth a suggestion that the former is the parent stock of the latter.

The breed has undergone much improvement, and to-day in France one will see fine examples of these cattle, neat and trim of head, wide and deep of body, thick through the heart, short of leg, with well-turned quarters. These improved Cotentins rather suggest the influence of Short-horn blood in times past; in fact, many years ago the Shorthorn cross met with favor.

There is good reason to assume that the cattle on the Island of Guernsey are descended from those of Cotentin type in Normandy.

Remarkable reports are given as to the weight of these cattle. Richardson states that the fat ox used in the annual procession in Paris was mostly chosen from this breed, and sometimes exceeded 550 stone of 8 pounds, which would mean 4,400 pounds. Inasmuch as the French secure their weights through a process of measurement, or by estimate, we may feel sure that such figures are extravagant, yet truly indicating that the beast must be large.

A recent document from Normandy relative to the Cotentin states that at two and one-half years of age they produce approximately from 800 to 1,000 pounds of profitable meat—a reasonable statement. They fatten easily on pasture lands and compare favorably with other breeds destined for the meat market.

The traveler through Normandy with an eye for cattle is impressed with the evidence of large milk production to be seen among the cows in the pasture. The Cotentin is regarded as a remarkable milk producer, surpassing any other French breed. It has long been famous in that respect, and the Department of Calvados is noted for its immense production of dairy products.

In 1883 United States Consul John B. Glover, at Havre, France, wrote:

"Probably no other country in the world, of like size, produces more good butter than the Department of Calvados. Small villages in this region export to Paris large quantities of butter annually. The town of Isigny alone sends nearly 6,000,000 pounds every year. Gournay also sends 3,000,000 pounds."

So popular is the name of Isigny butter that, sad to say, much more butter is sold under that brand in Paris than comes from that favored spot.

An annual milk yield for the Cotentin of 6,000 pounds is regarded as a fair statement of average production, testing about 3.88 per cent fat. The pastures of Normandy are said to give a very attractive flavor to the milk.

The cattle of Normandy have been exported to many parts of the world. Considerable numbers have been sent to Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Uruguay. In 1888 Mr. Chester W. Chapin, of New York, imported for his farm at Chicopee, Massachusetts, a bull and two heifers. Mr. T. A. Havemeyer also made an importation in the early nineties for his farm at Mahwah, New Jersey, which he

used for crossing with Jerseys. These importations bore no fruit of importance and the breed has passed from sight in this country.

BRITTANYS

Native cattle of the Province of Brittany, in the extreme western part of France, are known by the French as the Breton race. There are two types of this breed. One is small, lean, and of dairy type, the purest in ancestry and bred more especially in the Department of Morbihan. The other, of larger size, tending more to beef production, known also as the Bordelais race, is most common in the vicinity of Bordeaux.

Much of the Brittany country is of inferior fertility, and the cattle are given very little attention; hence they must be hardy to withstand the privations they undergo.

Brittany is the most distinctive cattle province of France. In Saint Herbot the French possess the one patron saint of cattle. Three days each year in May are devoted to his memory by the peasantry, who gather at the sixteenth-century chapel in the Department of Finistère, where his body rests.

During these days, we are told, all the work cattle in Cornouailles rest from labor. At one time they accompanied their masters, and if not taken on the pilgrimage they were reputed to find their way to the shrine alone. Now, by authority of the saint himself, their presence is no longer required at this celebration in his honor, provided a handful of hair from the tail of each animal is deposited upon the altar. The hair thus consecrated is said to fetch a goodly sum each year.

The origin of Brittany cattle dates into the misty past. The opinion has been expressed that they are descended from the small form of prehistoric ox known as *Bos longifrons*, having a similar ancestry to certain small cattle native to Norway, Sweden, and the British Isles.

Some French authorities have thought the cattle of Brittany were of Dutch ancestry of inferior size. It has also been suggested that the parent stock may have come from the "Indies." As in many similar cases, however, we have no evidence of importance regarding their origin.

Brittany cattle are usually black and white, the black predominating. There are also those of red and white, especially in Finistère. This is one of the smallest breeds, the true type being 36 to 40 inches high, and weighing from 300 to 400 pounds.

These cattle are noted among the French as producers of a relatively large amount of rich milk, an average annual yield of 1,600 liters (3,635 pounds), testing 5.7 per cent fat, according to Thierry. The Breton housewife is famous for her butter, and we are told by Richardson that the reputation of Brittany butter was first gained at the Château of La Prévalaye, about two miles from Rennes.

Efforts have been made to improve the cattle of Brittany. The Ayrshire and Jersey were introduced to increase the milk-producing quality, but without material benefit, and these crosses were discontinued. In 1877 Richardson

wrote that the Shorthorn was distinctly asserting itself against prejudice where the land is good enough, or farmed sufficiently well to give nourishing food. This is the case along the northern coast, and as far into the interior as good farming extends, but not on the southern coast.

In Finistère the Shorthorn is accepted more cordially, and it is not uncommon for a few small farmers to club together to buy a Shorthorn bull for general use. The mating of such extremes in size is somewhat illogical, but it has resulted in superior beef production in Brittany.

There are in this province of France cattle closely resembling the Jersey of a century or less ago, and the opinion prevails that the ancestral stock on the Island of Jersey came from animals in Brittany of this type.

NIVERNAIS

Among the hills of central France is the Department of Nièvre and the old Province of Bourbonnais. The upper waters of the Loire wind their tortuous way through this region, finding their source not far from the Rhône. Here, on the grass-covered hills, one sees the famous white cattle of France. Being native to Charolais, in Burgundy, the adjoining country to the east, these cattle are here known by this name. They have attained such fame, however, in the Nièvre that they are known as Nivernais-Charolais.

Charolais cattle are supposed to have been introduced into Nivernais about 1775 by a farmer from Brionnais. Here they did so well that the farmers generally engaged in breeding and feeding them.

The general form is that of the superior beef animal, with broad back, deep, capacious body, and short legs. The head is short, the forehead broad, the muzzle wide, the eyes prominent, and the comparatively small, white horns are gracefully curved forward and upward. The neck is short, as it should be, the bosom full, while the hind quarter shows the depth and thickness consistent with beef production.

A coat of pure-white hair and the reddish flesh color of skin on the muzzle and about the eyes suggest the white Shorthorn. In fact, white bulls of the latter breed were used many years ago in improving these cattle.

Richardson gives an interesting statement of a M. Colcombet, living in a district in the Bourbonnais where the Charolais breed prevailed, who developed a herd of white Shorthorns. He purchased a complete set of both the English (Coates') and French Shorthorn Herd Books and traced back from generation to generation the accidents of color in each family. With this knowledge he was able to select his stock with such certainty that he attained complete success. At the time of the show at Moulins in 1877 he had had 40 calves dropped, each perfectly white, without a single hair of red or roan. A Booth-bred bull, Silver Cloud, was an important factor in securing the results sought.

In the competitions at the Paris cattle shows the Nivernais-Charolais cattle have repeatedly won the highest awards. As producers of first-

rate beef in France, they may be regarded as in a class by themselves among French breeds. They require more care and better feeding, however, than most breeds, and, when thus attended, give the expected returns. At two and a half years of age the well-fed animals weigh approximately 1,500 pounds. The better class of cows at maturity weigh from 1,400 to 1,600 pounds, and the bulls 2,000 pounds or more.

There are fine farms among the valleys of the Nivernais and Bourbonnais, and whether drawing a load of hay along the highway, hauling the plow in the field, or grazing on the hill-sides, these beautiful white cattle lend a charm to the landscape. No wonder Rosa Bonheur found among the hills in the heart of France the right setting for her famous cattle picture, "Ploughing in the Nivernais," purchased by the French Government, and now in the Luxembourg Gallery.

In 1900 the Société Départementale d'Agriculture de la Nièvre established the Nivernais-Charolais Herd Book at Nevers, since which time many volumes have been published.

LIMOUSIN

Along the southern border of the central section of France is the old Province of Limousin. It is a country of hills and valleys, with mountains approaching 2,500 feet. Here and there are productive arable areas, but as a whole the country is not attractive agriculturally. A large proportion of its 2,000,000 acres is given up to grass and the raising of herds and flocks.

Here, we do not know for how long, the people have engaged in raising the Limousin breed of cattle. It is of medium size, yellow-red, with a lighter shade on the lower limbs, and with a body conformation suggestive of superior beef production.

In recent years the breed has been improved, and at the present time is regarded as one of the best in France. The many fine specimens seen in La Villette yards at Paris, as well as in the smaller markets of the south, bear testimony to that fact. The Limousin is celebrated for its docility, adaptability for draft labor, and early fattening. While not a recognized dairy-type breed, many of the cows yield a creditable amount of milk. M. Thierry, a French authority, says they produce annually 1,500 to 1,600 liters of milk, rich in casein, from which excellent cheese is made.

DUTCH BELTED

(For illustration, see Color Plate IX)

In the Provinces of Utrecht and North Holland are the Lakenfeld cattle, known in America as the Dutch Belted. These peculiarly marked cattle, of medium-size dairy type, black in color, except for a white belt about the body, originated in the hands of the Dutch nobility.

The first importation of Dutch Belted cattle into America was by United States Consul D. H. Haight in 1838. The first importation of importance, however, was made in 1840 by P. T. Barnum, the great showman, who obtained a few animals, for show purposes only, by



Painting from life by Edward Herbert Miner

Copyright National Geographic Society
HOLSTEIN-FRIESIANS, AN IMPROVED DAIRY TYPE OF NETHERLANDS ORIGIN



Copyright National Geographic Society

HEREFORDS, AN IMPROVED BEEF BREED OF ENGLISH ORIGIN

Painting from life by Edward Herbert Miner

agreeing that they were to be used principally for exhibition, as a feature of his circus. Mr. Barnum's herd was exhibited for several years as a rare and aristocratic breed, but subsequently was placed on a farm, thus becoming the progenitors of the Dutch Belted cattle in the United States.

In 1909 the Dutch Belted Cattle Association was incorporated under the laws of New Jersey. At that time most of the Dutch Belted cattle were owned in New Jersey and New York, but to-day representatives of the breed are to be found in almost every State in the Union.

This association has published 12 volumes of its herd books, containing pedigrees of all animals registered up to April 1, 1924. The number of registered females on record is approximately 3,300 and the males about 1,600.

In 1920 the Dutch Belted Cattle Association formed an Advance Registry Department, and highly creditable records have been made in official tests. To encourage this work, the association offered three silver cups to the owners of the three highest record cows. First prize went to Andrew Quackenboss, St. Cloud, Wisconsin, owner of Glenbeulah Beauty, which completed an official record of 13,295.8 pounds of milk, with 531.19 pounds of butterfat; second prize to Dr. J. G. Du Puis, Lemon City, Florida, owner of Ferndell, whose record was 13,477.9 pounds of milk carrying 501.1 pounds of butterfat; third prize to J. A. Wilson, Brunswick, Maine, owner of Fritz, with a record of 11,352.95 pounds of milk and 435.79 pounds of butterfat. Ferndell's record made her the champion dairy cow of Florida over all breeds.

In 1920 and 1922 a Florida herd, including the junior two-year-old class and seniors, on a 305-day A. R. O. official test, milked twice daily, completed an average of 9,998 pounds of milk, showing 427 pounds of butterfat. In this herd at the present time is a noted 12-year-old cow, Gem of Columbia, that has an official test of 17,285 pounds of milk showing 634 pounds of butterfat, on a strictly standard trial, running with 250 milking cows every day of her test period. This cow had previously completed a record of over 14,000 pounds before starting this last test, and has been milked continuously ever since she freshened the first time as a two-year-old heifer.

Princess B, in a Missouri cow-testing association, made a record of 15,998 pounds of milk and 712 pounds of butterfat.

HOLSTEIN-FRIESIAN

(For illustration, see Color Plate X)

The breeding of cattle has been an important industry with the Dutch for many centuries. According to Tacitus, in A. D. 28 Drusus, the father of Germanicus, imposed a tax of oxen hides upon the Friesians. It has been assumed by some writers that these early cattle were descended from the Urus, a primitive type of wild cattle inhabiting the forest lands of north central Europe.

Be that as it may, the people of the Netherlands have for centuries bred cattle of large

size that are especially given to milk production. These cattle are not all alike, or of the same breed, a few provinces or districts being distinguished for herds possessing breed characters more or less different from those of their neighbors. Numerous old paintings of Dutch masters make apparent some of these differences.

In North Holland and in Friesland there has been developed a large breed of cattle, commonly black-and-white spotted, or pied, although red and white are occasionally seen. The males at maturity attain 2,000 pounds or more in weight and incline to be a trifle long and straight of face, with short, powerful, forward-curving horns, very muscular neck, and a large-framed, lean, muscular body. The cows are also characterized by a moderately long and straight face, small, incurving horns, slender neck, large body, and capacious udder.

These cattle of dairy type have been widely distributed over the more fertile lowlands of continental Europe, where they have been highly valued for their wonderful milk-producing qualities. The Friesians of Friesland, the Holland or Hollandais of other sections of the Netherlands, Belgium, France, Oldenburg, Holstein, and western Germany, the Jutland of Denmark, the Fribourg of Switzerland, the Holstein-Friesian of America, or the British Friesian of England are all essentially the same in type, color, and in milk-producing characteristics.

The designation of Dutch has been applied to such cattle, very generally, all through Europe, for no other Continental type has met with such widespread favor. While in continental Europe they are noted for large milk yields, the published records are very modest in comparison with those coming from England, New Zealand, and the United States, many Holstein-Friesian cows in our country having exceeded an annual yield of 25,000 pounds of milk.

South African Friesians imported into England in recent years have sold at large prices, one lot of 28 bulls realizing an average of £1,383, and 55 cows and heifers averaging £1,171, one bull bringing 3,900 guineas and one cow 4,300 guineas.

While the American name for this large black-and-white dairy type of cattle is Holstein or Holstein-Friesian, it should be Friesian, the word Holstein being a misnomer, having been applied in error as to origin.

When the Dutch colonized New York, then known as New Netherlands, they brought Dutch cattle with them to the valleys of the Hudson and Mohawk; but when New Netherlands was ceded to the British Crown and British settlers came over with British cattle, the Dutch cattle seem to have disappeared.

The first record that we have of a special importation from Holland was that made in 1795 by the Holland Land Company, which had large holdings in New York. We find that William Jarvis, of Vermont, also imported a few of these cattle, and later Herman Le Roy, of New York, brought a few into the Genesee Valley; but none of these people kept records or tried to maintain the blood pure, and it was

soon lost through mixture with the common cattle of the country.

In the sixties Winthrop W. Chenery and William A. Russell, of Massachusetts, together with William H. Tilton, of Maine, and the Miller Brothers, of New York, made importations of Dutch cattle, and for the first time records were kept. In the seventies the Unadilla Valley Association was formed in New York for the importation of Dutch cattle, and it also kept records. The first of these groups united with those to whom they had sold cattle and formed the Holstein Breeders' Association of America, while the second group and their friends formed the Dutch Friesian Association.

The first Holstein Herd Book was issued in 1872, and nine volumes were issued under that name. The Dutch Friesian Association also issued a Herd Book, of which four volumes were in time published. The two associations united in 1885, under the name of Holstein-Friesian Association of America, and the cattle are now officially known as Holstein-Friesians.

Dutch cattle were introduced at an opportune time, as the dairy industry in America was beginning to expand and farmer-dairymen were in need of a breed which would make large returns in milk production. There was a strong demand from the very beginning for the Dutch cattle, and they have rapidly increased in number until they have spread all over the United States and Canada and are the most numerous breed in practically all leading dairy sections of the country.

The Holstein-Friesian Association has become the largest of all the breed associations, and, counting in the Holstein and Dutch Friesian registrations, to the close of 1923 had recorded 1,317,022 animals in its Herd Book, of which 427,003 were bulls and 890,019 were cows.

In productive capacity Holstein-Friesian cows astonished even their owners, and early in the history of the breed in this country great records were reported. These began at 16,000 pounds of milk a year and soon ran up to a production of above 30,000 pounds, made by the New York cow Pietertje 2d. In 1882 *The Breeder's Gazette* offered a cup for the largest American 30-day butter production, and this trophy was won by the Holstein-Friesian cow Mercedes, owned by T. B. Wales, then secretary of the Holstein-Friesian Association, which defeated that of the famous Jersey, Mary Ann of St. Lamberts, by a few pounds of butter.

In 1887 a dairy show was held in New York, at which prizes were offered for butter production, and the winner was the Holstein-Friesian cow Clothilde. At the same show Holstein-Friesian butter carried off the honors. The butter production developed by Mercedes and Clothilde centered attention on Holstein-Friesian capacity in both yield of milk and total butterfat.

The Holstein-Friesian Association was the first to establish an advanced registry system, now common to all the dairy breeds. Mr. Solomon Hoxie, secretary of the association, had in mind some system which would assure the improvement of a dairy breed through selection in breeding. This idea was the germ of ad-

vanced registration, and its beginnings are found in the Dutch Friesian Herd Book, whose system specified that any purebred cow might be recorded in the pedigree register, but only cows that had met certain requirements in milk production should be recorded in the main register.

When the two associations breeding Dutch cattle united, one part of the agreement was that the new association should establish an advanced registry system, and when this was done the Holstein secretary, Mr. T. B. Wales, became secretary of the joint association, while Mr. Hoxie became superintendent of advanced registration. Mr. Hoxie was superintendent for 20 years, retiring in 1905.

Advanced registration was first based on churned-butter production for a period of seven days, the results of each test being sworn to by all engaged in the making; and this plan was continued for ten years. The amount of churned butter required for a heifer freshening at just two years of age was 10 pounds, and the requirement was increased for each day of age up to five years, at which time the requirement was 15 pounds of churned butter.

The first four volumes of the Advanced Register contained the records made under this plan, which was not quite the success hoped for, because it did not have the full confidence of the public. In 1895 the method of testing was changed. State agricultural colleges began to supervise the conduct of the tests and made advanced registration the great success that it has since become. The Babcock test had been perfected, and instead of churned butter, the butterfat in the milk is quickly and accurately determined. This improved plan of testing was designated as official, the cows so tested being termed Advanced Registry Official, or A. R. O.

Some 110,000 different cows have been tested and admitted to advanced registration, of which nearly half have been tested more than once; so that more than 150,000 tests have been made. Bulls are admitted on records of daughters, any bull having four or more A. R. daughters being admitted to advanced registration himself. More than 7,000 such bulls have been admitted to date.

To show the improvement in short-time official testing, it may be mentioned that the seven-day average of 18 years ago showed an average production for cows and heifers tested of 408.1 pounds of milk containing 14.401 pounds of fat, while during the last testing year the average shown was 469.8 pounds of milk containing 17.538 pounds of fat. In long-period testing the average production for 1912 was 14,381.8 pounds of milk containing 494.87 pounds of fat in 342 days; in 1923 the average was 17,037.7 pounds of milk containing 574.85 pounds of fat in 337 days. It must be borne in mind that about half of the productions included in the breed averages are those of heifers with first or second calves.

Eighty-two Holstein-Friesian cows have produced above 1,000 pounds of fat in one year. The largest fat production is that of the cow De Kol Plus Segis Dixie, credited, under strictly official test, with 33,464.7 pounds of milk containing 1,349.31 pounds of fat. The largest



Painting from life by Edward Herbert Miner

Copyright National Geographic Society

JERSEY COWS, AN IMPROVED DAIRY TYPE OF CHANNEL ISLAND ORIGIN



Copyright National Geographic Society

Painting from life by Edward Herbert Miner

GUERNSEY COWS, AN IMPROVED DAIRY TYPE OF CHANNEL ISLAND ORIGIN

milk production was that shown by the cow Segis Pietertje Prospect, credited with 37,381.4 pounds of milk containing 1,158.95 pounds of fat. It was only a few years ago that the first Holstein-Friesian cow touched the 1,000-pound fat mark; and there are now 88 such records.

MINOR DUTCH TYPES

There are a number of other varieties of cattle in the Netherlands. In parts of North and South Holland, but more especially in the Province of Groningen, from which it gets its name, is a beef breed, usually black in color, except for more or less white in head, legs and tail, suggesting an Aberdeen-Angus-Hereford cross. In the Provinces of Drenthe and Overijssel may be found a very few cattle of the so-called Drenthe breed, which is similar in color and character to the Ayrshire of half a century ago. The Flemish or Zealand cattle have long been bred in Zealand, though of recent years in but a small way. This ancient type of the Zealand cattle is accurately shown in the famous picture of "The Bull," by Paul Potter, painted in the seventeenth century and now in the Gallery at The Hague.

DENMARK AND DAIRYING

The cattle industry in Denmark prior to the middle of the last century was of quite secondary importance. Up to that time the attention of the farmer had been devoted to general agriculture, with the small cereals as his main source of income. Realizing that the rewards for his industry were small because he was competing most unfavorably with other countries, he turned his attention to dairying.

The cattle of Denmark, upon which the dairy industry must rely for its supply of milk, were hardy and could subsist upon rather meager diet, but they had gone through no important period of improvement up to about 1850. There were then in Denmark several native so-called breeds which were generally regarded as rather productive milkers.

The more prosperous farmers of the country were the first to interest themselves in dairying, especially butter-making. The Danes realized that they had much to learn, so they established agricultural schools and experiment stations. Government experts visited the farmers and advised them, introducing better methods than those formerly used. After the milk separator was invented, a great impetus was given to dairying, and coöperative agriculture here began its most important development.* With this forward movement came the improvement of two breeds of cattle, to the exclusion of all other native stock.

The Red Danish breed is more especially found on the islands of Fünen and Zealand and the southern part of Jutland, on the mainland. It is regarded as a very old breed and, as its name indicates, is of a solid red color. Its improvement was begun by introducing superior milking stock from Angeln, in Schleswig, a

territory contiguous to Denmark on the south.

The Angeln cattle were much better milkers than the Red Danish, but were not so rugged. The process of crossing continued more or less until about 40 years ago, since which time improvements have been obtained by careful selection. Many cattle breeders' associations were formed, and the breed became substantially improved in type, in uniformity of reproduction, and in milk yield. In 1883 United States Consul Ryder, at Copenhagen, reported that "there are large numbers of these cows which give an annual yield of 8,000 pounds of milk."

In recent years important official tests of production of milk and butter have been conducted, covering two-year periods. In 1919 some 700 cow-testing associations in Denmark included in their work 16,000 herds and more than 200,000 cows. During the 1913-15 tests about 300 cows averaged 9,341 pounds of milk and 398 pounds of butter. One herd averaged 10,551 pounds of milk, and we are told that a yield of 16,000 pounds of milk is not remarkable. The percentage of fat in the milk ranges from $3\frac{1}{2}$ to 4, and this percentage is improving.

Red Danish cows at maturity weigh 900 to 1,200 pounds and, while of dairy type, when dry they fatten easily. This is now recognized as one of the more important dairy breeds of continental Europe.

Notwithstanding the merits of the breed, Red Danish cattle are as yet unknown in America; in fact, they are little known outside of their native home. On the valuable pastures of Fünen they are commonly tethered by chain and rope, and so are restricted in their grazing areas. Each day the cows are moved the length of the tether to fresh pasture.

There is a Red Danish Cattle Breeders' Association which promotes the purity of the breed and publishes a Herd Book, the first volume of which appeared in 1896.

Nothing seems to be known of the origin of the Jutland cattle on the mainland of the Danish peninsula. They are usually black and white, rarely gray and white. In appearance they suggest a close relationship with the black and white cattle of the Low Countries. Professor Rasmussen states that in the period from 1820 to 1850 efforts were made to improve the Jutland cattle by an infusion of new blood, and animals were imported from Tyrol, Switzerland, England, and Holstein. However, this crossing did not result in an improvement and was, therefore, discontinued.

Prior to the development of dairying in Denmark, these cattle were valued chiefly as producers of beef, but the increasing value of dairy products caused Jutland cattle breeders to pursue a careful policy of selection favoring the type of cow yielding milk abundantly; so, in the course of time, this breed has developed into what is essentially a dual-purpose type. In 1916-17 about 98,000 cows under test by 309 cow-testing associations gave an average yield of 6,719 pounds of milk testing 3.57 per cent fat. While this is regarded as a breed of medium size, Jutland cows range in weight from 1,000 to 1,600 pounds and aged bulls in good condition may weigh over 2,500 pounds.

* See, also, "Denmark and the Danes," by Maurice Francis Egan, Litt. D., in the NATIONAL GEOGRAPHIC MAGAZINE for August, 1922.

BELGIAN BREEDS

Prior to the World War the Belgians recognized the following six so-called breeds, or, as termed by them, races of cattle: Limon, Condroz, Herve, Ardennais, Campine, and Flamande. A study of these breeds, as exhibited at the biennial shows of Belgian breeds of cattle, held at Brussels, impresses the observer with the predominant influence of the large black and white cattle of the Netherlands and the red, white, and roan Shorthorn native across the Channel.

The World War brought about a serious change in the cattle situation in Belgium, for the invaders slaughtered much of the livestock or exported it to Germany, and breed conditions were left in a state of chaos. With the cessation of hostilities, large numbers of cattle were sent into Belgium to replenish the herds and primarily to provide milk for the children. This brought into the country a new seeding of Dutch and Shorthorn blood.

At the present time the Belgian Government recognizes four races of cattle—red, red and white, blue (or roan), and black and white. The red race, also known as Red Flemish, is very suggestive of the Shorthorn and is valued for beef and milk. It is best suited to extreme western Belgium. In the red and white race, there are two subraces, the Campine and Flemish Spotted. The Campine is bred along the Dutch border, on sandy or very light lands, and is more valued for milk than for beef production, the better grades of cows producing about 15,000 pounds of milk testing 4 per cent fat in 300 days.

The blue race is characterized by a coat of hair in which the black and white are mingled as in roan, but with the red shade lacking. In fact, within this race of Shorthorn type may be found animals that are entirely black or entirely white. These cattle are especially valued for beef and are best adapted to central Belgium, where the soil is most fertile. The black and white race is essentially the Friesian, or Hollandais, and is valued for dairy purposes, more especially cheese making.

SCANDINAVIAN RACES

The breeds of cattle of the more northerly sections of Europe, especially from 60 degrees north, have attracted very little attention. This is due to unfavorable climatic conditions and to a population rather sparsely distributed over mountainous or timbered regions generally unsuited to livestock husbandry.

The cattle of Norway and Sweden tend to be small, resembling in that respect those of Brittany, the Channel Islands, Shetlands, and the Kerries of Ireland. Weights of mature animals commonly range from 600 to 800 pounds, while the dairy or dual-purpose type meet with most favor, milk production being the first consideration. Red Polled and Ayrshire cattle have been introduced to a considerable extent from Great Britain and have done very well in the more southerly latitudes.

In Norway a number of breeds have been on record for several centuries. In the western and

southwestern sections there are cattle with and without horns and of various colors, such as black, dun, gray, or red. Near the more southwestern sections the Vest-Agder cattle, red and polled, resemble the Red Polled of the more milky type.

The Telemark cattle, native to several districts of middle and southeastern Norway, of which Telemark is one, are commonly red of head and body, but with a strip of white along the back, from the horned head to the tail, and with the breast, belly, and legs more or less white. This is a mountain breed, deep of body and short of leg, the cows weighing from 700 to 800 pounds and producing approximately 5,000 pounds of milk a year.

In a more southeasterly section of Norway, in the upland valleys known as Gudbrandsdal and Østerdal, is a gray or reddish-gray, horned breed, the cows of which yield about 4,000 pounds of 4 per cent milk. Two little-known breeds are found in the north-central section of Norway. Røros cattle, in the highlands south of Trondhjem, are polled and are sometimes nearly white, except for more or less red, gray, or black markings along the sides. Another breed, the red Tronder cattle, found in Trondelag, is horned and solid red. These two breeds are of distinctly dairy type and tend to be small of size.

There are four well-known breeds in Sweden—the Friesian, Ayrshire, Red and White Swedish, and White Polled, or Mountain. The Friesians were imported from the Netherlands a century ago and the Ayrshires from Scotland in 1847. These cattle are promoted by Swedish breed associations and are most abundant in the more fertile level sections of South Sweden.

The Red and White Swedish originated some 40 years ago, from crossing Shorthorns and Ayrshires on the native red cattle. This is a dairy type of good size, the better cows yielding nearly 10,000 pounds of milk a year.

White Polled cattle are found in the highlands of North Sweden, and so are also known as "mountain cattle." They are generally white, perhaps slightly mottled with small black or brown spots, of dairy type, and weigh about 900 pounds.

SOUTHERN EUROPEAN STOCKS

A surprising number of breeds, or so-called breeds, of cattle are credited to the various European countries by livestock authorities. For example, Diffloth's "Races Bovines" describes more than 40 breeds more or less common in France.

While some of the more important British and Dutch breeds have been distributed over continental Europe, most of the native breeds are limited to restricted areas or districts and derive their names from the localities in which they originated. Many of these European breeds show no evidence of constructive breeding and have little to commend them to persons familiar with the ones more highly developed.

Cattle are used very generally for labor in continental Europe; therefore, over much of



Copyright National Geographic Society

Painting from life by Edward Herbert Miner

DEVON COW, AN IMPROVED BEEF AND DAIRY BREED OF ENGLISH ORIGIN

THE CATTLE OF THE WORLD



Copyright National Geographic Society

Painting from life by Edward Herbert Miner

WEST HIGHLANDERS, SMALL MOUNTAIN BEEF BREED OF SCOTTISH ORIGIN

France, Germany, Russia, and the southern European States, size, strength, and docility are regarded as valuable attributes.

There are certain characteristic features of the cattle of southern Europe. The forehead is short in proportion to the distance between eyes and end of nose. The neck is very rough and muscular, especially with the males, with a heavy edging of skin, known as the dewlap, on its lower side. The horns are of medium size or large, according to the breed.

Extremely long, heavy horns are found on some of the cattle of Italy, Spain, and Hungary, a spread of five feet between the tips being occasionally seen on the cattle of those countries.

While the color varies according to the breed, it is more often solid than parti-colored. A light or silver gray or fawn, approaching white, is characteristic of a number of breeds, of which the Chianina of Tuscany, the Castilian of Spain, and the Campagna of Italy are good examples. There are also breeds of dark fawn, red or brown, with light shadings about the eyes, muzzle, along the backbone, and in some cases along the belly and inner side of the legs.

The White Back cattle of Poland present an interesting example of a very marked departure from solid color, with more or less white on head, back, belly, tail, and legs.

Lydekker states that fawn or chestnut was especially favored by the ancient Romans in their cattle, and it is this color which is most prevalent among the cattle of the Gallego and Navarra districts of Spain, while certain white cattle may be the descendants of the Roman sacrificial breed.

The skin of the southern European cattle tends to be heavy to the touch and is shorter and thinner of coat than prevails on the cattle of more northern latitudes. Not only the skin, but the bone as well, tend to be heavy, with the joints expressive of coarseness.

Milk production is not well developed, as a rule, among the breeds of continental Europe, except in the Netherlands, Denmark, and Switzerland. Germany has been an extensive importer of Dutch cattle, and their influence has been beneficial in improved milk production.

Temperamentally, the cattle of southern Europe, notably along the Mediterranean shores, are extremely quiet and especially adapted to draft purposes, for which they are so much valued. They are not all so, however, for in Spain, where bullfights are a popular amusement, a specialty is made of breeding fighting bulls.

THE HEREFORD

(For illustration, see Color Plate XI)

The established trade-mark of the Hereford is a white face. Wherever you see that, accompanied by a red body with a few white markings on legs, crest, or lower line, you may be sure you are looking at a specimen of one of the most efficient bovine machines yet produced for the conversion of grass into beef, especially under climatic conditions that are not so dependably met by other breeds.

The Hereford is the product of generations of intelligent work on the part of the tenant farmers and landed proprietors of the fertile valleys of the Severn and the Wye, in the west of England. While it has not extended its dominion particularly beyond the confines of Herefordshire in the British Isles, it has proved the one great leader of the bovine kingdom as the successor of the American Bison on the vast grazing grounds of the western United States, and as such it divides honors fairly with the Shorthorn and the Aberdeen-Angus as a factor in the total beef supply of this continent.

In situations where feed is abundant, as in the corn and blue-grass areas, other breeds compete upon even terms; but on the plains and high plateaus of the arid Rocky Mountain regions of the West on the open range, the Hereford reigned practically supreme, because of proved ability to cope with the conditions surrounding cattle-raising in a land where beasts often had to "rustle" actively for the bare necessities of bovine life.

The Shorthorn is used satisfactorily in some cases as a "cross" designed to maintain size, but Western cowmen, as a whole, testify that they can no more get far away from the Hereford hardiness upon extensive pastures than Western flock-owners can depart from the sturdy, close-wooled merino sheep in favor of the English mutton types.

This being the case, the Hereford must be set down as one of the greatest assets of the American cattle trade, in so far as beef-making is concerned. Other breeds make wonderful developments in the feedlots of the Central valleys and the East, but in the range country proper, all the way from the Rio Grande to the grassy reaches of the Canadian Northwest, the Hereford is still the favorite type.

In the remote past we find kinship between the Hereford, the Devon, and the Sussex—the red color, as is commonly assumed, dominant in all three breeds being derived probably from a French or Norman source. Just how the white face and markings came to differentiate the Herefords from their relatives of adjacent shires is not definitely known.

Herefordshire is noted for its luxuriant grasses, and as far back as agricultural records exist it is clear that the farmers of that district put beef production and value for draft purposes in their cattle stocks above dairy propensity. They wanted weight and strength at the yoke; and, as their lands were not so rugged as those in Devonshire, they could utilize a larger beast for the grazing.

And so it came to pass in the course of time that the heavy flesh-bearing red-with-white-face breed, which has in modern days proved such a blessing to Western America, was established.

The first great improver was Benjamin Tomkins, a county magnate with the Briton's inborn love for good domestic animals. He was followed by John Price, who made careful selections from the best of the Tomkins blood and inbred the blood, so that it made deep impress wherever used by his contemporaries.

and successors. He sought beef, with little regard for milk.

Then came the Hewers, the Jeffries, Knight of Downton Castle, the Greens, the Tudges, Benjamin Rogers, John Price of Court House, Lord Berwick, Taylor, the Edwards, Stephen Robinson, Aaron Rogers, Thomas Carwardine, the Turners, and a galaxy of the ablest men who ever gave time, money, and talent to livestock improvement.

The story of the Hereford in America may be divided into two periods: the first and least important, their early introduction into the Central and Eastern States, and, secondly, their advent upon the Western ranges. It has been generally believed that Messrs. Goff & Miller, who made the initial importation of Teeswater Shorthorns into Virginia in 1786, brought in also at least one bull of Hereford blood. It is known that the importation included a few Longhorns.

While the Shorthorn blood predominated in the first of these Virginia cattle taken into Kentucky, a celebrated stock bull in the early days of cattle breeding in the blue grass country, belonging to the so-called Patton (Goff & Miller) stock, known as Mars, was described as "a deep red with a white face," and there can be little doubt that he was of Herefordshire origin, and his blood was widely used in laying the foundations of Kentucky and Ohio cattle-breeding operations.

In 1825 Hereford blood came into New England, Admiral Coffin, of the English Navy (born in Boston), presenting a pair to the Massachusetts Society for the Promotion of Agriculture. This bull lived to the age of 19 years and left a valuable progeny, of which Mr. Sanford Howard, who was interested in cattle breeding in Maine and Massachusetts, writes:

"I saw many of the bull's progeny in the vicinity where he was first kept, and owned some of them. They made prodigiously powerful and active draft cattle; there was a majesty in their gait and an elasticity and quickness of movement which I never saw equaled and which, together with their beautiful mahogany color and strong constitutions, made them decided favorites with the Yankee teamsters."

The popularity of the get of this bull led to an important importation by Mr. Howard, for account of the Messrs. Vaughan, into the State of Maine in 1830. In the hands of Messrs. Burleigh & Bodwell the descendants of this importation acquired great reputation throughout New England.

In 1840 Hon. Erastus Corning, of New York, imported 22 head from Herefordshire. These fell into the hands of William Henry Sotham, who undertook to popularize the breed in the West, but with no particular success. He sold a good lot, however, to Hon. John Merryman, of Cockeysville, Maryland, who later became one of the best-known American breeders of his time.

In 1846 Phineas Pendleton, a sea captain of Searsport, Maine, brought over a pair of Hereford calves that constituted the founda-

tion of the famous Underwood herds in Maine. A few subsequent importations were made into Massachusetts, and in 1852 two Herefordshire farmers, emigrating to northern Ohio, brought the first of the blood direct from the old country into that State. They made another importation in 1860, and during that same year Hon. Frederick William Stone, a Warwickshire man who had immigrated to Ontario, made an importation into Canada. Descendants of these Ohio and Canadian cattle subsequently supplied the material for the first great experiments with the blood of the Hereford in the West.

Up to 1870 it may be said that, outside of New England, where oxen were in regular use at the yoke, the Hereford had not made any particular headway against the Shorthorn, which by that date was a prime favorite in American cattle-breeding operations all the way from Massachusetts Bay to the Missouri River. But a great day for the Hereford was dawning.

In southern Texas, soon after the close of the Civil War, Captain Richard King and his friend, Captain Mifflin Kennedy, were unwittingly preparing the way for the great Western cattle-grazing industry.

These men, beginning with Spanish Longhorns, assembled large herds near the Mexican Gulf coast, obtaining control of vast tracts of grass for that purpose. From this nucleus cattle ranching extended north and west until by the middle seventies it had grown to large proportions.

The Kentucky and Missouri Shorthorn herds had been drawn upon for improving the Longhorns, so that when the first Herefords were taken to Colorado and northern Texas for experimental purposes the foundation had already been provided.

As early as 1876 favorable reports as to the results of the use of white-faced bulls on the range began to come in. T. L. Miller, a Chicago business man owning a farm at Beecher, Illinois, had already espoused the Hereford cause and, sensing the possibilities involved in the Western trade, began an enthusiastic campaign to promote the adoption of Hereford bulls throughout the entire range country.

The hard winter of 1880-81 clinched the claims of the white-faces as the one breed best capable of facing grief, and from that day to this the ascendancy of the breed on the Western ranges has been maintained.

To meet the Western demand, great numbers of the best animals to be found in Herefordshire were imported during the eighties. In fact, the very flower of the breed in its native land was practically transferred to Indiana, Illinois, Iowa, and Missouri pastures. Wealthy men, interested in good cattle, dipped deeply into their bank balances to induce the old-country breeders to part with their very best, and it was not many years before a distinct improvement over the old Herefordshire type became apparent.

Special recognition in this connection should be made to such pioneer importers and breeders as Gudgell & Simpson, of Missouri; C. M.



Painting from life by Edward Herbert Miner

RED POLLED NORFOLK BULL, AN IMPROVED BREED OF ENGLISH ORIGIN
ESTEEMED BOTH FOR BEEF AND FOR DAIRY PURPOSES

Copyright National Geographic Society



Painting by Edward Herbert Miner

RED AFRICANDER BULL, OF SOUTH AFRICAN CAPE ORIGIN, A BEEF ANIMAL

Copyright National Geographic Society

Culbertson and Thomas Clark, of Illinois; Earl & Stuart and William S. Van Natta, of Indiana.

American breeders essayed the task of introducing finer finish. The heads and horns, as well as the hind quarters, were improved, largely by resort to the concentration of blood of animals possessing the desired points, and at the present time it may be said that the American Hereford is more uniform in type and symmetry than his English progenitors.

The fact that 1,423,483 head of purely bred Herefords have been registered by the American Hereford Cattle Breeders' Association, and that this great expansion has taken place in comparatively recent years, demonstrates what a remarkable hold the "white-faces" have obtained in this their adopted country.

The secretary of the association, which boasts 12,208 stockholders and the patronage of 6,000 breeders not members of the organization, computes that there are at the present writing more than 400,000 registered Hereford cattle in the United States. He claims that there are more than 400,000 registered Hereford cattle service here—20,000 more than of any other registered beef breed—and 25 States are supposed to have more registered Herefords than registered cattle of any other beef breed. Good herds are still maintained in the New England States and steady progress is being recorded throughout the entire South.

In the Western America trade, Texas and the Southwest have become the favorite breeding grounds, although fine herds for the production of "seed stock" for use upon the range are also maintained in Colorado, Wyoming, Montana, and the Dakotas.

A dominant feature of cattle-feeding in the Corn Belt proper at the present time is the shipment of Southwestern-bred Hereford calves into the feedlots of the Central valleys, to be finished as "baby beef" for the Chicago, Kansas City, and Omaha markets.

In South America the Hereford is extensively used in connection with operations upon leading estancias in Argentina, Uruguay, and southern Brazil. In Australia and in the South African Cape colonies the breed has also been successfully introduced. In fact, wherever grass grows, and especially wherever a forlorn hope has to be led in range operations, the hardy Hereford has made fast friends.

POLLED HEREFORDS

In 1898, at the Trans-Mississippi Exposition, at Omaha, there were exhibited by W. W. Guthrie, Atchison, Kansas, under the name of Polled Kansans, some naturally hornless cattle carrying the color markings and possessing considerable of the type of standard Herefords. They were the result of mating purebred Hereford cows to a "muley" bull possessing a white face and red body, but of unknown ancestry, presumably, however, a Polled Short-horn-Hereford cross.

Seeing these cattle, and also some crossbred Red Polled-Hereford calves on his own farm, gave Mr. Warren Gammon, of Des Moines,

Iowa, the idea of the value of a naturally hornless strain of purebred Herefords, if it could be developed. Mr. Gammon learned that "sports," "variations," or "freaks" are constantly occurring among all species of plants and animals, and that by proper matings such "sports" can be propagated true to the new type. He therefore determined to search for such a "sport" purebred Hereford that would differ from the standard Hereford only in the lack of horns.

A circular inquiry, sent in the fall of 1900 to about 2,500 members of the American Hereford Cattle Breeders' Association, brought replies indicating that fourteen such hornless purebred and recorded Herefords were in existence, four being bulls and ten cows. The four bulls and seven of the cows were purchased as an experimental foundation herd.

In addition to the polled cows, a number of registered horned Hereford cows were mated with the polled bulls. The progeny from these matings showed that nearly all calves from polled sires and polled dams were hornless, as were about half those from polled bulls and horned cows. From this foundation herd the present breed or strain of Polled Herefords has been developed.

When it was demonstrated that polled bulls would sire polled calves from horned cows, the pioneer and his associates immediately assembled herds of registered horned Hereford females of desirable blood lines, and as fast as polled bulls were available they were put in service with these horned cows. The new strain was thus very rapidly increased in numbers until now, at the end of 24 years, there are upward of 50,000 Polled Herefords recorded in the American Polled Hereford Record.

Polled Herefords have spread into every State in the Union save Delaware and New Jersey, and have been exported to Canada, Mexico, South America, Hawaii, the Philippines, and Australia.

The American Polled Hereford Breeders' Association, the national breed organization, has enrolled more than 2,000 members, and there are in excess of 12,000 herds of cattle in the United States headed by Polled Hereford bulls.

Springing from "sports" occurring among purebred Herefords, the polled breed differs in no way from standard Herefords except in the possession of the polled character. With the recognized advantages of the hornless head in beef production, they have met with favor wherever introduced. Because of limited numbers and the resulting higher prices, they have only recently gone to the Western ranges in any considerable numbers, but during the last few seasons they have been in strong demand from that section.

THE JERSEY

(For illustration, see Color Plate XII)

On the French side of the English Channel, within sight of the west coast of Normandy, lie the Channel Islands. Formerly they be-

longed to France, but since the year 1204 they have been under British sovereignty. Of these islands, only four are important—Jersey, Guernsey, Alderney, and Sark—in the order given. It has been assumed that at one time these islands were a part of the French mainland.

Jersey is about twelve miles long and seven miles wide and contains nearly 40,000 acres. Its north shore consists of high cliffs, from which the land gradually slopes southward to St. Aubin's Bay and the city of St. Helier. The island is divided into twelve parishes and has a population of about 50,000. The climate is extremely mild and the island is a popular health resort.

Jersey is an agricultural island, some 25,000 acres being under tillage. Potato growing and the breeding of Jersey cattle are the two leading industries. The farms are small, commonly ranging from two to five acres, yet 500,000 bushels of potatoes have been harvested here in a season. Some 10,000 head of cattle are maintained on Jersey, in the open air most of the year, tethered on the rich pastures by a combination rope and chain fastened to an iron peg in the ground. Here they are systematically grazed, the tethered animal being moved forward to fresh grazing as the necessity arises.

The ancestry of Jersey cattle is obscure. It is commonly thought, however, that they are descended from French cattle; the fawn or white color has been attributed to the cattle of Normandy and the darker color to those of Brittany.

The people of Jersey many years ago recognized the value of their cattle and early adopted measures to protect the purity of the breed. As early as 1763 the island legislature prohibited importations from France. In 1789 a law was passed making importations from France, except for immediate slaughter, a crime. At the present time no cattle may be brought to the island except for slaughter within 24 hours.

A scale of points or a standard of perfection, now commonly applied to farm animals, first received serious consideration on Jersey. In 1833 the Royal Jersey Agricultural Society was organized and the following year a scale of points for the improvement of the cattle was adopted. The standard bull must score 25 points and the cow 27. At the first show held on the island, in 1834, the judges said that the cattle were of poor shape, that the cows had bad udders, and that some of the females had short, bull necks, were heavy of shoulder, etc. From time to time the score card was revised, a practice of rigid selection was followed, and the cattle steadily improved in beauty and productive merit.

The exportation of cattle from the island has been associated with their improvement. Even prior to the eighteenth century, Jerseys had been exported to England, where they were first known as French or Alderney cattle. Under the name of Alderney, the first Jerseys probably found their way to this country.

About 1821 Philip Dauncey, of England, be-

gan the development of a Jersey herd. He improved his cattle greatly through systematic breeding, and may be considered the first great constructive breeder of Jerseys. He maintained a dairy of 50 cows, each of which netted him an annual profit of \$100 from sales of butter.

Jerseys were introduced to America very early in the nineteenth century, but no definite importation from the island seems recorded prior to 1850, when Messrs. Taintor, Buck, Norton, and other gentlemen near Hartford, Connecticut, imported a bull and several cows. Since 1850 many thousands of Jerseys have been shipped from their native island to America.

In general appearance Jersey cattle are lean and muscular, of dairy type, and are valued chiefly for milk production. Some of the more striking characteristics are as follows: The color is a fawn of some shade, such as brown, lemon, orange, gray, mulberry, black, etc. About the muzzle, around the eyes, along the back over the spine, down the inner side of legs, and about the udder the color changes to a lighter tint, approximating white on the legs. A solid color is most common and meets with great favor among Jersey breeders, but white spots of varying size are not unusual.

The skin, of a rich-yellow tint, is mellow and elastic. The head of the Jersey is one of its most attractive features, being lean and fairly short, graceful of contour, with prominent, expressive eyes. The fawn color, beautiful head, and graceful form of the young Jersey heifer has caused many to refer to her as "deerlike."

Jersey breeders have done much to develop a symmetrical udder, a model of its kind. In size, Jerseys at maturity range from small to medium, with 850 to 900 pounds for cows and 1,300 to 1,400 for bulls meeting popular favor.

Jerseys mature early and usually possess superior vitality, many cows of the breed having lived 20 years or more. The cows are mild and gentle of disposition, but the bulls at maturity are apt to be nervous and irritable.

Jerseys produce a grade of milk rich in butterfat, testing about 5 per cent. Remarkable yields are recorded of these cows. The American Jersey Cattle Club, the official supervisor of the breed in this country, provides a "register of merit," the cows being tested for milk and butterfat by representatives of agricultural colleges or experiment stations. In 1923 there were 3,250 cows tested, more than 300 of which qualified for gold or silver medals. Fauvic's Star holds the high milk record for the breed—20,616 pounds in a year—while Darling's Jolly Lassie, Groff's Constance and Princess Emma of H. S. F. have produced 1,141, 1,130, and 1,110 pounds of butterfat, respectively, in a year—most remarkable records.

Much has been done by various organizations to promote this breed. Besides the American Jersey Cattle Club, in 1923 there were 299 State and county clubs, 123 bull associations, and 213 boys' and girls' Jersey calf clubs. The American Jersey Cattle Club promotes the purity of the breed, and since 1871



Painting from life by Edward Herbert Miner

AYRSHIRE COWS, AN IMPROVED DAIRY TYPE OF SCOTTISH ORIGIN

Copyright National Geographic Society



Copyright National Geographic Society
ABERDEEN-ANGUS, AN IMPROVED BLACK POLLED (OR HORNLESS) BEEF BREED OF SCOTTISH ORIGIN
Painting from life by Edward Herbert Miner

has published some 106 volumes of Herd Books, containing the registration of more than 900,000 animals.

Jerseys are widely bred over the world, with many herds in the United States and Great Britain. There are nearly 20,000 breeders in this country alone, with Ohio and Texas leading. The wide distribution of the Jersey is evidence of its popularity and adaptability to varying climatic conditions.

Canada has long been noted for its Jerseys, but the largest herd in the world is located in the extreme south of Texas, not far removed from the Mexican border. In the East, in New England Jerseys have been preëminent for nearly three-quarters of a century, while some of the most noted herds on this continent are to be found in Oregon.

THE GUERNSEY

(For illustration, see Color Plate XIII)

An island in the English Channel, with an area of only 24 square miles and only about 10,000 acres of productive soil, inhabited by a thrifty race of French descent, noted for its mild climate, its gardens, its greenhouses, its granite quarries, and, above all, for its cattle! Such is the seagirt home of the "golden Guernsey" cow.

As an object lesson in what may be achieved through intelligently directed "community spirit," concentrated upon the production of something possessing outstanding quality, the creation of the Guernsey breed of cattle, now enjoying such deserved popularity in the United States, must be set down as one of the great achievements of modern husbandry.

Guernsey cattle are fawn-colored, marked with white, and are larger than their widely distributed sister breed of Jersey. They possess a peculiarly rich-yellow skin, this coloring in some subtle way extending to the lacteal products in such marked degree that the milk, cream, and butter are in broad demand, at top prices, wherever produced. In fact, the Channel Island farmers have always laid great stress upon the relationship of the color of the skin to the color of the butter. The first scale of points prepared by the breed societies of the different islands, published about 100 years ago and revised in 1840, shows that practically the same scale was used by the entire group, and that all emphasized the yellow skin as indicating the production of yellow butter.

The first cattle from the Channel Islands, all then known as Alderneys, reached the United States more than 100 years ago. They were brought over either by travelers, who, visiting the islands, fell in love with the yellow milk and butter, or by skippers who had been similarly impressed.

The earliest importations into America of cattle whose records were completed, so that their descendants might eventually be registered, were made in 1830 and 1831. These cattle were maintained on Cow Island, in Lake Winnepesaukee, New Hampshire, without mixture of other blood, and among their descendants was a cow that twice won a grand cham-

pionship. The next importation of which there is record was in 1840, and this was followed by others in the fifties and sixties, but not until about 1880 did Guernseys come to America in any great numbers.

In 1881, S. C. Kent and a number of his Quaker neighbors in Chester County, Pennsylvania, began importing Guernseys and selling them at public sale, bringing over more than 1,000 in the course of 10 years. In the nineties and for the decade following, only a few were imported each year, but about 1908 they began to come over in much larger numbers and in recent years importations have been numerous.

Nearly all of the earlier imported cattle went into the hands of wealthy men, who had country estates around the large cities in the East, principally Boston and Philadelphia. They began to come into the West in the early eighties, and at once became popular in the dairy sections.

Wisconsin now has about one-quarter of all the purebred Guernseys in the country. Pennsylvania, New York, and Minnesota follow, while representatives of the breed are to be found in every State in the Union. Nearly 100,000 bulls and 175,000 females have been recorded.

The generally accepted statement as to the origin of the Guernsey is that it is a cross between the large red cattle of Normandy and the small yellow and red cattle of Brittany. It seems certain that up to about 100 years ago the cattle on all the Channel Islands were practically of one type, and were at that time being shipped in large numbers to England.

Records show that from 1822 to 1826, inclusive, 184 bulls and 10,575 cows were exported from the Channel Islands to England. Even the cattle that were exported to England from Normandy were also referred to as Alderneys when they reached Great Britain.

The development of the breed on the Island of Guernsey, until very recent times, was largely along show-yard lines. Records do not tell when the first public exhibitions were held, but it certainly was as far back as 1842. The earliest photographs of the breed were made about 1865, but paintings and engravings were made much earlier and indicate that the cattle were rough and angular.

At least two shows are held on Guernsey each year. The most coveted prize is the King's Cup for the best cow and best bull, and the owner of a bull winning a King's Cup, if he accepts it, must let the bull stand on the island for public service for the next year at a very nominal fee, and if the animal is sold from the island before the year is up the cup is forfeited.

The one thing which, perhaps more than any other, has aided in the improvement of the Guernsey breed is the rule that no bull could stand for service on the island and the progeny be recorded if used before 15 months of age, or if used before he had been approved for service and his dam be either a prize winner at the shows or be approved by the committee at the time the son was approved for service.

In recent years the additional requirement has been made that the bull must be out of a cow with an official record.

Following the establishment of yearly official testing in America in 1901, the island Guernsey societies adopted rules along similar lines, and since that date several hundred yearly records have been completed on the island, revealing a production ranging up to 899.48 pounds of butterfat. Until recent years the island cows had practically nothing but pasture in summer and almost exclusively roots and hay in the winter, but now grain is fed, especially to cows making records.

The American Guernsey Cattle Club was organized in 1877 by a few breeders living in the Eastern States. The scale of points in use by the club has been revised three or four times. In 1898 it offered some prizes for yearly butter records made on the owners' farms and somewhat supervised by State experiment stations. The first year's work brought out the record of 783.7 pounds of fat for the cow Lilly Ella, owned in Wisconsin, and her half-sister, Lilyita, made 710 pounds of fat. These records were so remarkable that they attracted general attention, and following the completion of that year's work the club adopted rules for an Advanced Registry based on yearly semiofficial tests.

Of these annual records 17,651 had been approved up to May 1, 1924, and they show an average of 9,443.48 pounds of milk and 471.34 pounds of fat. The largest milk record for the breed is Murne Cowan's production of 24,008 pounds of milk, with 1,098.18 pounds of fat, which is the second largest fat record of the breed. The largest fat record is Countess Prue's, with 1,103.28 pounds.

THE ENGLISH LONGHORN

While this picturesque, old-fashioned British breed is still to be seen in its native land, and while specimens were imported into the United States along with the Herefords and Shorthorns, brought into Virginia and Kentucky more than a century ago, it has never regained the popularity it once enjoyed in the English Midland counties.

It is a dual-purpose type, possessing scale and dairy capacity, and takes its name from its peculiar wide-branching (and frequently down-curving) horns. At one time they were known locally in Lancashire as "Wag Horns," because of the manner in which the horn bent underneath the eye. Specimens are still to be seen with horns thrown outward and downward alongside the head, constituting an almost circular "frame" for the face. Ordinarily, however, the horns start laterally from their base, taking various twists as they develop.

The Longhorn seems to have been developed originally in the northwestern parts of England, and was once common on the plains and in the mountains of Ireland. In England it was found in Lancashire, Cumberland, and Westmorland; and, in fact, to the south as far as the Bristol Channel. The prevailing colors originally were black and brown, with more or less white on the body and a streak of white down the back.

The Longhorn had been improved by selective matings in the Midlands long before Bakewell made them the basis of his extended experiments in pairing animals of near kin. In fact, he selected the breed for his projected manipulations because at that time (1755) it was the most popular type of the time in the central counties. He sought specifically to produce cattle with less carcass waste, maturing more rapidly than the old type.

Dairy quality Bakewell ignored, saying, "All is useless that is not beef." He sought to change the conformation, so as to develop those parts most valuable upon the block, the back and hind quarters. The exact extent to which he carried incestuous matings in pursuit of his object he never made fully known. In fact, his practices were at first so sharply criticized by his contemporaries that he maintained secrecy even with his own herdsmen. He experimented with Leicester sheep at the same time along similar lines, and one trusty old shepherd was the only person who really knew what was going on.

Bakewell held to his own course, despite ridicule and predictions of failure, and while the particular breeds with which he wrought never attained the popularity of certain contemporary types, it was the practical application of his method to the Shorthorns, Herefords, and other races that gave modern English cattle breeding its first great impetus.

In the fells of Westmorland and Cumberland the Longhorn was highly regarded because of its hardiness, thriving in the hill country, even through the winter months, without roots or shelter. It had a thick hide and strong coat, but did not reach maturity at so early an age as the Shorthorn, Hereford, and other contemporary breeds.

The breed has undergone various modifications in color. Dark roan, with black "ticks" and white line along the back was popular for years. Formerly a bluish tint was in favor, but a dark red, brindled or grizzled, with the white line on the back, has in recent years been more popular with those who still adhere to the type.

Professor Robert Wallace, of Edinburgh University, in his "Farm Live Stock of Great Britain," says:

"As dairy cattle, they frequently produce from 14 pounds up to 17 and 18 pounds of butter per week on ordinary pasture. Good cows will give on an average about eight quarts of milk twice daily. Greater attention is now paid to them, owing to the relatively higher prices given for milking cows, especially for cheese dairies, than for butchers' beasts."

DEVONS

(For illustration, see Color Plate XIV)

Devonshire has long been famous as the home of a breed generally recognized as one of the oldest distinct types of improved cattle in Great Britain. The Devons are commonly classified with the Sussex and Herefords in respect to ancient derivation, and have for generations existed in two forms, the North Devon and the South Devon (or South Ham) varieties.



Copyright National Geographic Society

Painting by Edward Herbert Miner

TEXAS LONGHORN, OF SPANISH ORIGIN

In the hills of North Devon, extending from Barnstaple to Minehead and on into West Somersetshire, the North Devon is the pride of the countryside. All red, with neat bone and well-spread ribs, the "rubies," as they are often called in bovine parlance, not only make up into bullocks that are prime favorites in the Smithfield market, but the cows are noted for their pronounced dairy quality.

Smaller than the Hereford and Shorthorn, the Devon is perfectly adapted to grazing in a hill country, and has found favor in many parts of the world, including the United States, New South Wales, the African Cape, southern Brazil, and Uruguay.

The South Devons are larger than the Northern type and are lighter in color. The North Devon is a deep rich red, sometimes with curly hair, which is in favor. The Southern variety has a yellower hide and heavier bone, but lacks the refinement of its cousins of the higher-lying pastures.

Francis Quartly, a North Devon man, is credited with having wrought as great an improvement in the Devon breed as the Collings did with the Shorthorn, or Tomkins with the Hereford. He adopted the Bakewell concentration policy and with immediate results, securing both uniformity and prepotency. His active creative work covered the period from 1793 to 1823, and his herd became the chief source of supply for stock bulls for the entire district. His practice was to use only bulls of his own breeding, buying females for fresh blood when deemed desirable.

Quartly continued his herd for 43 years, retiring in 1836 in favor of his nephew, John Quartly. This rare old Devon worthy lived to the age of 92, and his name stands high in the list of Britain's foremost constructive cattle breeders.

The earliest known importation of Devons into the United States was that made in 1817 by Robert Patterson, of Baltimore. Strangely enough, these were not from Devonshire, but from a splendid herd that had been established in Norfolk by the Earl of Leicester. The total registrations in the Herd Book of the American Devon Cattle Club are: 9,638 males, 16,660 females, nearly three times as many animals of each sex having been registered in 1925 as in 1924.

Devon milk is rich in butterfat and "Devonshire clotted cream" is famous on both sides of the Atlantic.

WEST HIGHLANDERS

(For illustration, see Color Plate XV)

In the heather-topped mountains and wooded glens of Scotland the West Highland cattle have their home. Dotted here and there over the wild expanse of the counties of Argyll, Inverness, and Perth rise the summits of many peaks, culminating at 4,406 feet in Ben Nevis, the highest point of land on the British Isles. It is a country of brawling streams, of grassy hillsides, isolated farms, and a widely scattered population, where the very elements tend to create in an unusual degree in both man and

beast the spirit of self-reliance and independence.

Under such conditions has developed the West Highland breed of cattle, a type well suited to its rugged surroundings. Its origin goes back to prehistoric days of *Bos longifrons* from which many British breeds sprang (see text, page 645). Professor Wilson regards them as descendants of the black cattle which the Celts drove into the west and north when they retired before the English.

Little, however, is known of their history until relatively recent times, and in their present form one may be justified in regarding many of them as aboriginal in type, far removed in domesticity from our more improved breeds.

A typical West Highland animal, with wide-spreading, formidable-looking horns, long, shaggy coat of hair, and toplofty, independent carriage of head, makes an impressive picture on the landscape. James Cameron, a Scotch breeder, says: "A really good Highland bull in full October or November coat is one of the noblest and most picturesque of animals." On his native mountain side, he has been a favorite subject with artists. Even on the lowlands of England, small herds are pastured on the parks of the nobility, where they add a new charm to the scene.

West Highland cattle vary in color, being yellow, red, black, brindle, and a mixture of red and black. The hair at its best consists of a fine, very thick undercoat, and a long outer covering, through which the rain rarely penetrates. On the forehead, top of neck, and thighs the hair is extremely long and coarse. On the London market West Highland beef is ranked of premier quality, fine of grain, and unsurpassed in flavor.

No other breed of British ancestry equals the West Highland for hardiness and capacity to withstand winter exposure. It is a comparatively small breed, the cow averaging perhaps 900 pounds and the males 1,200, as one sees them on the hills. Reared under difficult conditions, inured to exposure, and getting most of their sustenance on the mountain sides, they are slow to mature.

Few of these cattle have found their way from the Scotch Highlands, for they do not satisfactorily adjust themselves to strange conditions. An occasional small importation has been brought to America, where for a time they have been viewed as curiosities and then have disappeared.

In 1884 a West Highland Cattle Society was organized in Scotland. It publishes a Herd Book and promotes the welfare of the breed.

FRENCH CANADIAN

In his "Pioneers of New France," Francis Parkman says:

"In 1518 Baron de Léry made an abortive attempt at settlement on Sable Island, where the cattle left by him remained and multiplied." This is the earliest recorded shipment of French cattle to the New World.

The foundations of cattle breeding on the mainland were not laid, however, until a century



Photograph by Charles J. Belden

"WHITE-FACES" ON THE RANGE

Herefords and Hereford grades may be seen everywhere on Western ranches. On account of their hardiness and rustling quality, they were admirably adapted to meet the hard conditions existing when the herds were maintained on the open range. With the advent, however, of fenced pastures and irrigation in the valleys, the other beef breeds are also now strongly supported in various sections. The Hereford's reputation as a grazer, however, is possibly not equaled. His ability to make beef off grass has made him famous (see text, page 630).



© Charles J. Belden

THE BRANDING

One of the most important operations on the Western cattle ranges is the branding of the calves. Begun in the spring, it is followed up, as necessity requires, until winter sets in again. Although most of the herds are now behind fences, the branding of the calves is still regarded as a necessary measure of protection and identification.



Photographic copy of painting by l'Abbé Henri Breuil

COPIES OF PREHISTORIC DRAWINGS OF A MALE AND FEMALE BISON ON THE WALLS OF A CAVE OF ALTAMIRA, NEAR SANTANDER, SPAIN

These paintings, estimated by some anthropologists as being perhaps 25,000 years old, are among the many interesting relics of early man found in the caves and grottoes of the Pyrenees. The cave at Altamira was discovered in 1875, but not until four years later was it known that prehistoric pictures decorated parts of its rocky walls and ceiling. The figures are painted on stone in red, black, and brown, and, because of the almost complete absence of light in the cavern, the colors are as vivid as if recently applied.

later. In 1620 a few cattle were landed at Quebec, and in 1665 Messrs. Tracey and de Courcelle brought from France a small shipment described as black and brindle in color. These early selections were from Brittany, Normandy, and probably from the Island of Jersey, and their descendants to this day are not unlike the darker Jerseys in coloring.

The climate and grazing of the Province of Quebec called for an active, hardy race, and under the name of French Canadian the farmers of that district have persistently adhered to these diminutive but exceedingly efficient cattle. Although weighing only from 700 to 1,000 pounds, the cows, with liberal feeding, will yield up to 5,000 to 6,000 pounds of milk per year, which tests frequently from 4 to 5 per cent fat.

This breed illustrates admirably the success with which types of cattle suited to any environment may be perfected. The French Canadian cows thrive and yield their good flow of rich milk upon such scant herbage that most other breeds would find it utterly insufficient.

At the present time dark brown is the favored color, but black, brown or fawn, with a brown or fawn stripe along the back and around the muzzle, is accepted. Calves are often somewhat yellow in color when born, but generally undergo a definite change as yearlings.

The cows are noted for the persistency of their milk yield. This fact finds illustration in the case of one registered as Adaline 5350, who, in her three-year-old form, under official test produced 8,705 pounds of milk in 12 months, showing 371 pounds of butterfat, and gave 494 pounds of milk during the last month of the test.

Attention was attracted in the United States to the utility of French Canadian cows through a remarkable showing in economical production made in a comparative test conducted during the Pan American Exposition, at Buffalo, in 1901. They have been imported into our North-eastern States to a limited extent, and a registration has been established for them both in the United States and the Province of Quebec.

RED POLLS

(For illustration, see Color Plate XVI)

This useful and popular dual-purpose breed in its present form represents a blending of the old hornless red stocks of Norfolk and Suffolk, England. Hornless, or polled, cattle seem to have existed in those districts from time immemorial. The probability seems to be that they were introduced soon after the Roman occupation.

Originally there was much variance of type in the two varieties. The Norfolks were a small, hardy, and thriving breed, neat-boned, short-legged, round-barreled, and strong-loined, fattening easily and producing an average flow of high-quality milk. The Suffolks were of larger frame, rougher in appearance, having flat loins, with prominent hip bones and tail head. They were exceptionally heavy milkers, but the quality of the milk was not so good as that of the Norfolks.

The merging of these two strains, beginning about 1846, proved the foundation of the present

breed. It has been the aim of the successful breeders and showmen to combine the good qualities of both of the old strains, and produce a cow of medium to large size, blood-red in color, of fine bone, smooth and compact in form, hardy, docile—one that will fatten easily, producing meat of high quality, and a cow that will give a good flow of rich milk all the year round.

There seems little doubt that our so-called native American "muley" cows are descendants, more or less mixed with other strains, of Norfolk and Suffolk cows brought over by early English emigrants.

The persistence with which the old Suffolk traits are transmitted, under what would seem adverse conditions, finds a striking illustration in what were known in Massachusetts as "Jamestown cattle." In 1847, during the famine in Ireland, the people of Boston sent a shipload of provisions to that country to relieve the distress. As a token of appreciation, a Mr. Jeffries, living near Cork, presented to the captain a Suffolk polled heifer. She was delivered by him to the donors of the provisions and was sold at auction for the benefit of the fund.

This cow proved to be a remarkably fine milker, and her progeny (mostly bulls by what were then known as Alderney sires) were largely used in the dairy herds around Boston.

The progeny of these half-blood Suffolk bulls were nearly all hornless and were so superior to the ordinary cattle of the district as to become noted. They derived the pseudonym Jamestown from the name of the vessel in which the heifer came over, and at several local fairs were shown in considerable numbers.

A. W. Cheever, agricultural editor of *The New England Farmer*, acquired a small herd of them, and after 15 years' experience said:

"We were thoroughly converted to a full faith in the superior qualities of the polled cow as a domestic animal."

While it is probable that various sporadic importations of the Red Polls had been made in Colonial days, the first historic importation for breeding purposes was made by G. F. Taber, of New York, in 1873. This consisted of a bull and three heifers. In 1875 he imported four cows in addition, and in 1882 three bulls and twenty-three heifers. During that same year Mead & Kimball, of Vermont, imported a bull and ten females, and in 1883 G. P. Squires, of New York, and Geldard & Busk, an English firm, made importations.

Thereafter the number brought over increased rapidly from year to year until about 1900, when the prices on the other side became so high that few importations have since been made.

The Model Dairy conducted at the Pan American Exposition at Buffalo in 1901 gave the first opportunity for Red Polled cows to compete with other breeds in economical production of milk and butterfat. There were ten breeds competing, and the Red Polls won fifth place. In individual cows Red Polls won second place, with a net profit of \$52.10. First place went to a Guernsey cow, with a net profit for the six months of \$59.41.

In this test all the Red Polled cows entered



Photograph by H. G. Olds

A \$60,000 SHORTHORN BULL

This two-year-old bull won the grand championship in the Argentine National Show of 1925, and subsequently was sold at auction for a record price, the equivalent of \$60,000 American gold. More than 1,000 head of Shorthorns were on exhibition, the largest display of show cattle of any breed held in the world.

were from one herd, and they had been in lactation from 42 to 70 days when the test began. Many of the breeds in competition with them had special experts traveling all over the country, selecting cows here and there; so, for competitors upon that occasion, the Red Polls were contending against picked individuals selected from the best herds of the entire country.

The inauguration of the Farmer's Cow Contest at the International Live Stock Exposition in Chicago in 1902 again gave the breed an opportunity to show its dual characteristics in competition with other breeds. The rating in this contest was as follows: Butterfat record of each cow during the period of lactation was to count 35 per cent; her individual merit, 25 per cent and her calf, 40 per cent. Red Polls were the winners in this contest in both 1902 and 1903, the only years that these classes were given.

In 1908 the American breeders established their score card and standard description, and this has been followed in both the showing and in making selection of breeding animals, thus standardizing type. During that year also the Red Polled Cattle Club inaugurated the Club Milk Test. The present world's official record for a Red Polled cow for twelve consecutive months is 20,280.6 pounds of milk and 891.58 pounds of butterfat. This record is held by Jean Du Luth Beauty.

The carcass classes at the International Live Stock Exposition at Chicago have developed valuable information. For a number of years Red Polls have been entered in these classes. The majority of entries of Red Polls in the carcass classes have been made by farmers who have bred, fed, and exhibited their own cattle.

In 1922 Red Polls won first in the senior yearling class and second in the junior yearling



THE WORLD'S CHAMPION DAIRY COW

The Australian-bred Shorthorn Melba 15th, of Darbalara, produced under official test during a 12-months' period 32,522 pounds of milk yielding 1,614 pounds of butterfat—a world's record for total production over all breeds.



Photograph by Robert F. Hildebrand

THE NEW QUEEN OF THE GUERNSEY WORLD

This cow, Anethesia's Faith of Hill Stead, has recently finished a year's official test, which is 19,741.7 pounds of milk and 1,112.5 pounds of butterfat.



A PAIR OF SHORTHORNS ALL "DOLLED UP" FOR THE SHOW

These heifers illustrate the beef type of a dual-purpose breed. Note the herdsman's work upon the coat of the red beauty on the left, preparatory to sending her into the showring.

class. These steers sold for 31 and 35 cents a pound, respectively, the highest prices ever received for any steers in the show, except the grand champion.

The dressing percentage of the senior yearling steer was 62.76 per cent, while that of the junior yearling was 64.95 per cent. As this competition included 52 entries from the herds of our greatest beef producers and from a number of agricultural colleges as well, the fact that the Red Polls were able to win these places with steers bred, fed, and exhibited by a farmer-owner shows the possibilities of the breed for the production of a choice quality of beef.

The usefulness of this breed is now well known the world over. Exportations have been made from England not only to the United States, but into Canada, South Africa, Australia, New Zealand, South and Central America, Mexico, Alaska, Hawaii, and Jamaica.

Until the World War, not many Red Polls

were found in England outside of the native counties of Norfolk and Suffolk, but the conflict brought about some notable agricultural readjustments, and, among others, a wider distribution of the Red Polls in various parts of England, Scotland, and Ireland.

The number of animals recorded in America to date is 48,397 bulls and 68,957 females. Of these, approximately 43,000 bulls and 58,000 females were American-bred animals.

SUSSEX

This English breed, found in Sussex, Kent, Surrey, and Hampshire, is obviously descended from the same parent stock as the Devonshires. Some authorities trace an ancestral relationship between the Sussex, the Devon, the Hereford, the Welsh, and the West Highlander. The Sussex has longer and stronger horns than the Devon. It is dark-red in color, is larger and heavier-boned than the Devon, and is valued



Photograph by Dave Risk

ABERDEEN-ANGUS BABY BEEVES

These calves were fed and shown by the boys' and girls' club members at a recent Iowa State fair and illustrate the type of beef cattle now commanding high prices in all central markets (see text, pages 632-633).

chiefly as a good grazer where beef rather than milk is sought.

In the district in which it is bred there are large areas of stiff, heavy-working soils, calling for great strength at the plow. The Sussex oxen were at one time extensively used as draft animals by these South of England farmers. They are a sturdy breed, and the British have introduced them successfully into South Africa.

In 1884 Mr. Overton Lea, of Nashville, Tennessee, made an importation of Sussex, and for some years maintained a good collection of the breed. The descendants of the Lea importations were distributed in various Southern States. Sussex have also been bred sparingly in Maine and in the Dominion of Canada. Mr. Lea made several notable exhibits of bullocks at the Chicago Fat Stock Shows of the eighties, his animals winning numerous prizes, and their showing of finely marbled beef on the block attracting much attention.

The Sussex has not attained any general distribution in the United States.

KERRIES AND DEXTERS

Kerry cattle as a distinct breed have existed in Ireland from very remote periods. In an address prepared for the Royal Dublin Agricultural Society some years ago, Professor James Wilson declared that "the Kerries are all now left of the races that once inhabited the whole island, but which have been gradually pushed out by imported cattle."

This conclusion is apparently substantiated by the fact that it is only in the mountainous districts of the County of Kerry and on the Berehaven Peninsula, in County Cork, that the breed is still to be found as the ordinary commercial cattle of the country, reared and found upon practically all holdings.

Herds of carefully bred specimens, now having registration in the office of the Kerry Cattle Society of Ireland, are to be found in various parts of Great Britain, but these are of comparatively modern establishment.

It is commonly conceded that the native Irish cattle were originally all black, and that is the color of the Kerries of to-day. Reddish-browns appear at times, and now and then a few white markings develop, but these are not approved by the breed association.

Kerry cattle are diminutive, averaging around 900 pounds, but for generations they have been loved by the Irish cottagers because of the capacity of the cows for producing a good flow of rich milk at a minimum cost. There is record of one herd, kept for 12 years, having an average yield of more than 600 gallons of milk with 4 per cent of butterfat. Records published by the Kerry association demonstrate surprising capacity at the pail, individual cows yielding up to 8,550 pounds in 12 months.

Twelve cows averaged between 6,000 and 7,000 pounds; 43 between 5,000 and 6,000 pounds. Butterfat percentages ran remarkably high, 8 cows averaging over 5 per cent and 62



© H. Armstrong Roberts

WEEK-OLD TWINS: AYRSHIRE CALVES FROM ONE OF PENNSYLVANIA'S FINEST HERDS

between 4 per cent and 5 per cent. There is also record of an extraordinary cow (Kilmorna Waterville 1st) that produced 11,126 pounds of milk in 1913, yielding $5\frac{1}{2}$ gallons per day for several months after calving.

The globule of the fat in Kerry milk is smaller than in most other breeds. The cream when set, therefore, does not rise so fast; hence the Kerry's reputation for "sweet milk." Butter made from the milk is also considered particularly "sweet." The cows carry upstanding, slender white horns; with black tips which often turn back. The bull's horns are shorter than the cow's and are commonly erect, with tips turned back.

A subvariety of the Kerry, known as the Dexter, has attained considerable popularity, both in Ireland and in England. The exact origin of the Dexter is not clearly traced, but

Professor Wilson, in his "Evolution of British Cattle," states that red cattle of North Devon type were taken to the south of Ireland a century or more ago and crossed with the native Kerry. He gives much credit to Devon influence and ascribes the red which occasionally occurs with Kerry and Dexter cattle to that source. He also states that the Devon transmitted the shortness of leg seen in the Dexter.

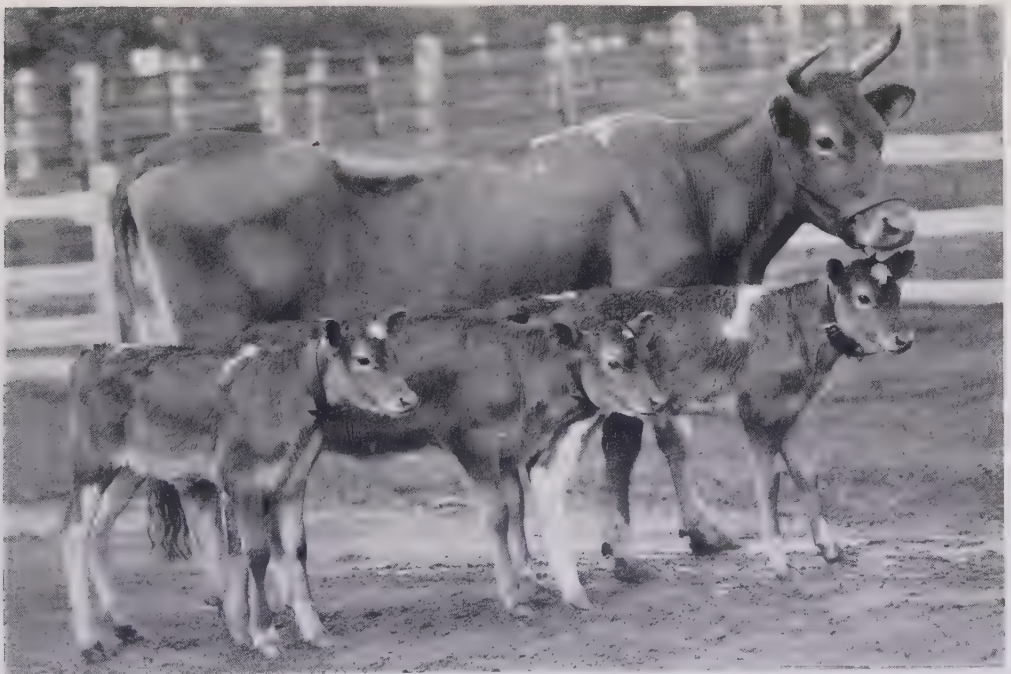
What was formerly the Kerry and Dexter Cattle Society of Ireland has recently changed its title to the Kerry Cattle Society of Ireland, and will no longer promote the Dexter. The Royal Dublin Society, the publisher of the Herd Book, has discontinued recording the Dexter. This is because of its alleged uncertainty in reproduction, the tendency of the cows, it is alleged, being to drop calves with "bulldog" heads.



Photograph from F. Hutchinson

A HOLSTEIN-FRIESIAN MOTHER AND HER QUADRUPLTS

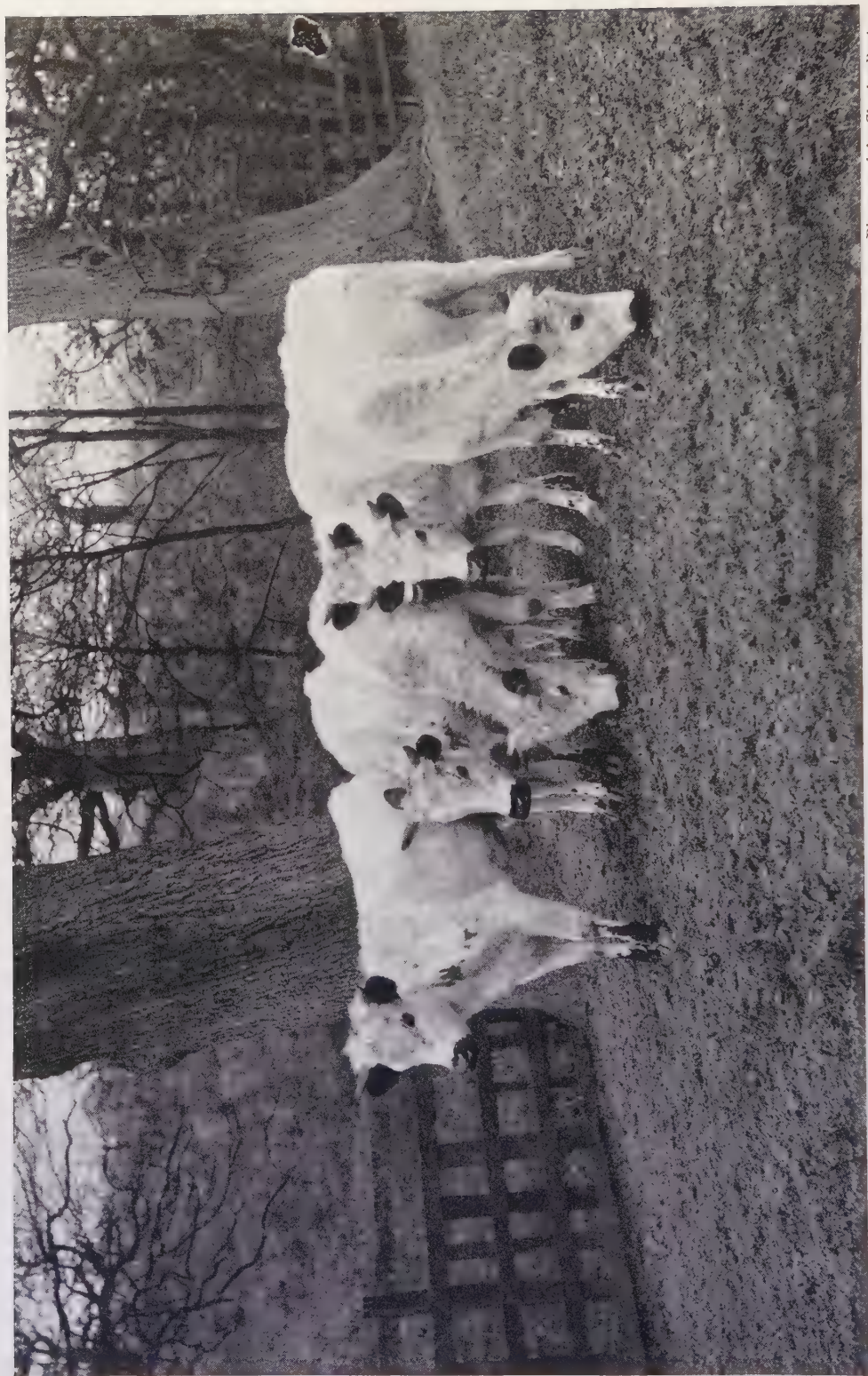
This cow, owned by Mr. W. E. Lawson (at the right), of Manitoba Province, Canada, on July 2, 1925, gave birth to four healthy, normal calves.



© H. A. Strohmeier, Jr.

GUERNSEY TRIPLETS

Three-of-a-kind are not common among cattle, and these were the first triplet heifers to be registered by the American Guernsey Cattle Club.



Photograph by Charles Reid

SCIIONS OF AN ANCIENT HOUSE

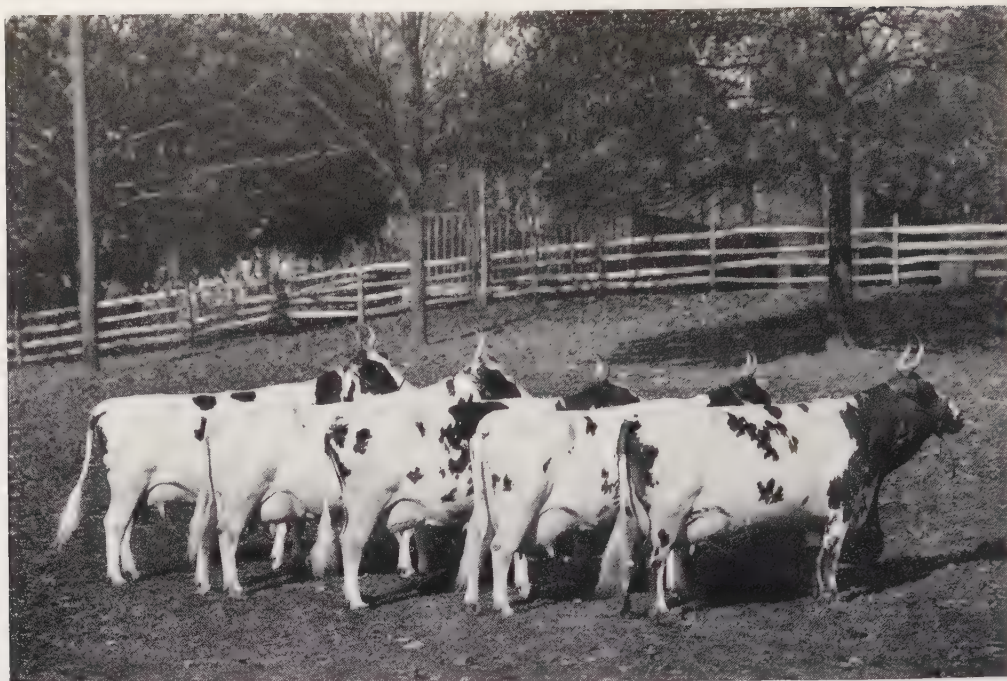
These Cadzow calves are examples of the so-called Wild White Cattle (see Color Plate VI), a few herds of which are still to be found in Great Britain. They are thought to be the nearest living connecting link to the prehistoric cattle of the British Isles and derive their name from Cadzow Castle Park, Lanarkshire, Scotland, in which their progenitors have roamed for several centuries.



Photograph by Harriet Chalmers Adams

BRAHMANS ON THE STREETS OF RIO DE JANEIRO

The sacred ox of India becomes a garbage carrier and jack of all work on the hills of Brazil's capital city. About 4 o'clock every afternoon all the oxen go down to the lower city, their work over for the day.



Photograph by H. A. Strohmeyer, Jr.

AYRSHIRE CHAMPIONS

This fine old Scottish dairy breed, while it has long been known in America, has of late years materially increased its popularity. The cows are noted for their splendid udders, strong, level quarters, deep bodies, and persistent flow of milk of the highest quality (see text, page 704).



Photograph by J. and J. Brown

A BELTED GALLOWAY BULL (SEE TEXT, PAGE 707)

An interesting offshoot of the shaggy-coated black polled Galloway breed of Scotland.



Photograph by H. A. Strohmeier, Jr.

PRINCESSES OF JERSEY

A quartet of shapely heifers whose ancestors came from the Channel Island of Jersey.

The small size of the Dexter is also objectionable from the Kerry standpoint. It is either black or red in color and is more compactly built than the Kerry, having a round, plump body and very short legs.

Dexters are sought by some of their admirers because of their diminutive size. Some very handsome specimens have weighed only about 500 pounds, and one noted bull, known as La Mancha Union Jack, stood only 38 inches high and weighed 500 pounds. The late King Edward was especially interested in Dexters and maintained one of the good herds of the breed.

Interesting experiments in crossing Dexters with larger British breeds have been made, crosses with the Shorthorn, Red Polled Norfolk, and Aberdeen-Angus producing some remarkably fine butcher's beasts, some of which have been shown at the Smithfield (London) show.

A few specimens of both KERRIES and DEXTERS have been imported into the United States and have attracted much attention as bovine novelties possessing practical utility. An American Kerry and Dexter Club was formed a few years ago, but the organization has been discontinued.

THE RED AFRICANDER

(For illustration, see Color Plate XVII)

South Africa is credited with having produced a type of cattle quite unsurpassed in point of splendid adaptation to its environment—the Red Africander breed.

There are now nearly 10,000,000 head of cattle of all sorts in the Union of South Africa,

maintained chiefly in the eastern or Indian Ocean coast colonies lying between Rhodesia and Cape Town.

In the eastern Transvaal, the high-veld area of the Orange Free State, Natal, and the eastern parts of the Cape Colony proper, the Taurine population is chiefly centered. In those areas dairying is an important industry, and it is interesting to note that transplanted Friesians have there been brought to an exceptional degree of excellence, fine specimens of Cape breeding having been exported to England for breeding purposes and sold at very high prices.

While the Friesians and other dairy types have found a profitable field here, there are ranching possibilities in Rhodesia and the northern Transvaal, in which the native cattle, and especially the improved Red African type, are chiefly employed as foundation stock. Crossed with Sussex, Hereford, or Shorthorn bulls, they produce grazing beasts of superior character, finding a good market at Johannesburg and other centers.

The Red Africans have existed as a distinct type for more than a century. They were developed by the early settlers from indigenous stock of unknown origin.

In the pre-railway days of South Africa the crying need of the colonies was for a good trek-ox for use in hauling the wagon trains that supplied necessary transportation—an animal that had activity, hardiness, speed at various paces, strength, docility, and intelligence.

The farmers of those early days rose to the occasion. The Africander ox, of uniform type



Photograph by Alice Schalek

AN OX TO THE RESCUE ON A MIRY ROAD IN CHOSŬN (KOREA)



Photograph by Captain Frank Harley

CATTLE OF THE SOUTH SEAS

Herd of British origin (Hereford and Shorthorn) grazing on a plantation in British New Guinea.



"PLOWING IN THE NIVERNAIS"

The original of this masterpiece hangs in the Luxembourg Gallery in Paris. It is one of the best works of the famous French animal painter, Rosa Bonheur.



Photograph by Camillo Schneider

CATTLE OF THE CENTRAL HUNGARIAN PLAIN

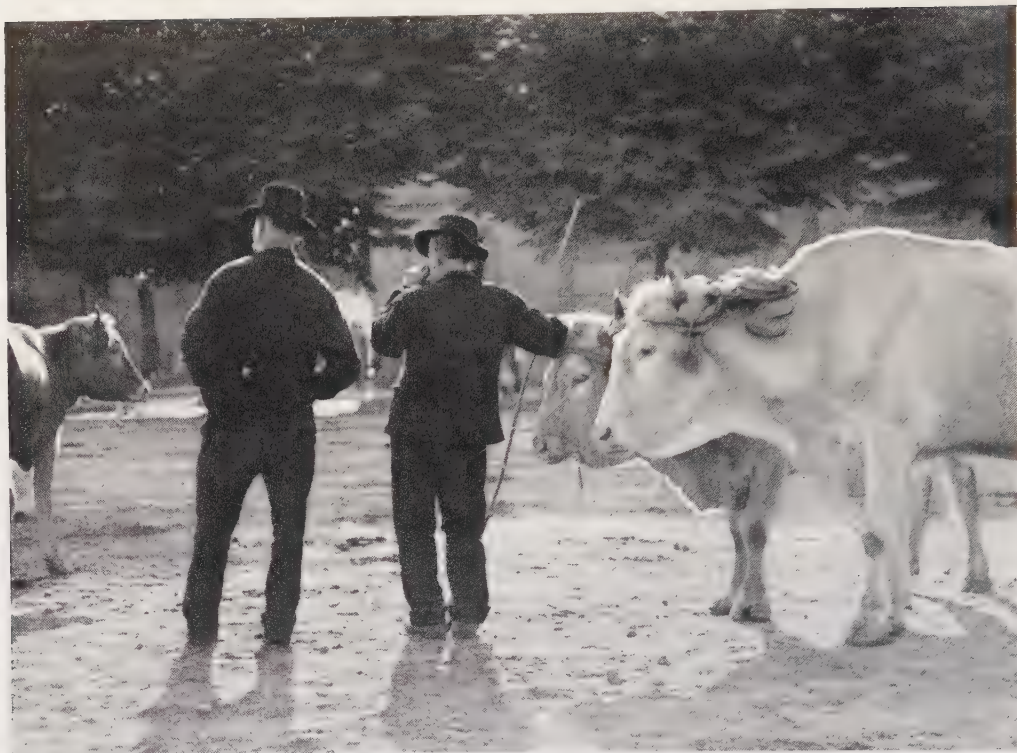
Because of poor flesh-forming and milk-yielding qualities, this type is giving way to less picturesque, but more useful, breeds.



Photograph from Helmig and Company

SACRED COWS OF BALI

In the Dutch East Indies certain cows are regarded as sacred. One of the features of the annual New Year's Festival on the island of Bali is a race between these sacred animals. For this occasion they are bedecked with fanciful headaddresses and enormous bells are hung about their necks.



Photograph by M. O. Dell

WHITE OXEN OF LE PUY, FRANCE



Photograph by Charles Reid

THE COWS GIVE THE MILK AND THE BULL CARTS IT TO THE STATION

Everybody works, including father, in the herd in Scotland to which this Jersey bull belongs.



PAUL POTTER'S "YOUNG BULL"

This is one of the most famous cattle pictures in the art museums of Europe. It hangs in the Gallery of The Hague (see text, under "Minor Dutch Types," page 664).

and color, met not only the requirements of the trails, but the demand for draft purposes in the fields. When the yoke-worn bullock was finally turned out upon the native grasses of the veld, he completed his service to his creators by fattening himself into good, edible beef.

A king Africander bull has not many superiors in impressive character among the improved breeds of other lands. Fully matured bullocks grown under veld conditions—that is, without shelter or food other than the natural grasses—weigh from 1,200 to 1,400 pounds. They naturally resist drouths, ticks, and other insects, as well as disease, better than imported breeds, and afford a basis for grazing operations even better than the Longhorn that made our own Western cattle ranching possible.

The voor-trekkers (early pioneers) who developed the Red Africander breed are entitled to rank with the bovine breed-builders of the Northern Hemisphere.

THE AYRSHIRES

(For illustration, see Color Plate XVIII)

A notable modern instance of rare constructive skill in manipulating bovine form and characteristics to suit a local environment is afforded by the case of the Ayrshire, the only breed of special dairy character originated in the British Isles. It was developed by the thrifty farmers of the Ayrshire district of southwestern Scotland, first by crossing a native

stock with other breeds, and later by carefully considered selective mating.

Most authorities have credited the old Teeswater stock as the most likely beginning of improvement, but infusions of various other bloods are also suggested as probable, including Wild Whites, Highland, and Channel Island crossing. The foundations of the now well-established race are thought to have been laid between 1750 and 1780.

The Ayrshire farms along the banks o' Doon and the gurgling Ayr, as well as on the hills that lead up to the highlands of southern Lanarkshire and North Dumfries, are small and the herds are close together. The country folk are neighborly and "each yin kens the ither's business." Consequently when one has something unusually "guid" the neighbors are certain to find it out.

So, in developing and perfecting the Ayrshire, when a certain sire begot better calves than those found in neighboring herds, his sons were readily salable to those who sought the improvement noted. Moreover, Scotch thriftiness led to the heavy use in service of any bull which proved himself a good breeder.

In this way full advantage was taken whenever an animal of extra transmitting qualities was produced, so that the breed was benefited in the largest way.

The Ayrshire was developed to fill a certain definite want. A dairy cow was needed, and the breeds already in existence were not adapted to the climatic and feeding conditions of Scot-



Photograph by Emil P. Albrecht

A TEAM IN THE PYRENEES

Among the mountains of southern France both ox and cow teams are in general use. Sometimes the yoke is fastened to the animals' necks, but more often it is bound to their horns and topped with an imposing-looking headdress of shaggy goatskin, which gives a very decorative effect.

land, where the development of root crops and a progressive agriculture made necessary the use of dairy animals.

Although other breeds had been tried and in some instances proved useful in the low, fertile valleys, yet none had been satisfactory on the hill farms in competition with the native stock said to have served as the foundation of the breed now called Ayrshire. A few men, therefore, set themselves the task of breeding an animal with the constitution and healthy vigor to withstand rigorous treatment by the elements and at the same time make an economic return for the rather scanty rations supplied.

The success of these Scotch breeders in their search for a dairy cow is attested by the popularity of the Ayrshire in Scotland and England to-day, to which special emphasis was given at the 1923 London Dairy Show, where Ayrshires

defeated the representatives of all other breeds, both in the showring and in the interbred milking contests.

Exportations have been made to many countries, and the breed has made good, under widely varying climatic conditions, from the Tropics to the Arctic, and in every longitude, from Sweden and Finland to South Africa and Australia; from Canada to Porto Rico and Mexico and Central America.

The first Ayrshires to reach America were imported into Canada more than 100 years ago. They were brought from Scotland because of their ability to withstand the rigors of an ocean voyage in those days and because of the excellence of their milk. While some Ayrshires are supposed to have reached Connecticut as early as 1822, the first definite record of importation is that of the Massachusetts Society



Photograph from Samuel G. Gordon

LOADING CATTLE AT SALAVERRY, PERU

Along the west coast of South America, where large ocean-going freighters cannot come close to the shore, cattle are loaded into open boats and towed out to deep water, where a derrick hoists them on board by means of a belt slung under them from front legs to hind quarters.

for the Promotion of Agriculture, in 1837. Importations in conservative numbers have been made with fair regularity since, the average for the last two decades being about 200 head per year.

The story of the Ayrshire's qualities early spread throughout the northeastern part of the United States. Accustomed to gaining a livelihood on the Scottish hills, it readily adapted itself to conditions in New England, which is to this day a stronghold for the breed.

More than a half century ago New York farmers, learning of the hardiness and profitableness of the Ayrshire stock to the eastward and in Canada, established herds, and that State now leads in the number of cattle of this breed, having nearly one-third of all in the country within its borders.

Pennsylvania has awakened to the breed's merits and has founded many splendid herds, while in the Middle West and on the Pacific coast, wherever dairying is developing, there is an increasing demand for breeding stock. Today Ayrshire herds may be found upon the hillsides of every State in the Union.

In 1923 a total of 7,077 American Ayrshires were purchased by breeders in 43 States, the Virgin Islands, Canada, Central America, and China. There are now registered in the Herd Books of the Ayrshire Breeders' Association, the record organization of the breed formed in 1875, a total of 113,467 Ayrshires, of which 82,980 are females.

An important factor in increasing the popularity of Ayrshires in the United States is the development of Advanced Registry testing. A



Photograph by A. W. Cutler

AN OX CART IN OPORTO, PORTUGAL, WITH A LOAD OF PORT WINE

Note the ornate carved yoke, which probably has been handed down from father to son for generations—a prized heirloom.



© Donald McLeish

DUTCH LANDMARKS

The windmill and the black-and-white cattle are almost equally characteristic of the Dutch countryside. The former is used for draining pastures for the latter to graze in, and the two, combined with the cleanliness and thrift of the people, have placed the Netherlands high in the ranks of the dairy nations.

number of highly creditable yearly productions have drawn the attention of dairy farmers to the fact that the type of the Ayrshire carries productive ability to a high degree. The highest of these records is that made by Garclaugh May Mischief, of 25,329 pounds of milk and 894.91 pounds of fat. This cow, the champion of the breed, is still milking profitably and reproducing regularly at Penshurst Farm, in Pennsylvania, at 18 years of age.

Records have proved the longevity of the breed and its long-continued productiveness, a number of 10,000-pound productions being recorded for cows more than 20 years of age.

The special pride of the breed lies, however,

in its averages rather than in individual production. In the past two years 1,353 records, more than 50 per cent of them made by immature animals and a number by those well past the age at which most dairy cows cease to be profitable, averaged 11,038 pounds of 4 per cent milk, the exact fat average being 441.44 pounds.

The uniform productive capacity of the breed inclines the owners of Ayrshires to favor the Scottish system of milk records, which provides for testing all cows in a herd rather than a selected few, as is frequently the practice in the United States. Consequently they are entering cooperative cow-testing associations and setting high records with sufficient frequency to estab-



Photograph by Smith and Morton

A BRAHMAN BULL AND HIS SHORTHORN OFFSPRING

Both the hump and horns present in the father are absent in the son, whose mother was a registered Polled Shorthorn. Brahmans have been introduced into the American Southwest because of their ability to withstand heat and drought and their immunity from the attacks of the cattle tick.

lish the Ayrshire's claim to marked uniformity in a heavy flow of 4 per cent milk.

Ayrshire cows weigh about 1,000 pounds and the bulls from 1,400 to 2,000 pounds. The color is white and red and brownish-red verging on the mahogany. The typical New England Ayrshire is red, with only a little white, but the more popular color in other sections, particularly with show-yard individuals, is white, with only a little red about the head and neck and a few spots scattered over the body.

The question of color is given relatively slight consideration when the animal is above the average in other respects. The horn is characteristic, being long and curving outward, upward, and slightly backward. The top line is very strong, the rib deep, the chest full, the barrel large, and the legs straight and strong. Ayrshire enthusiasts maintain that this breed's udder is the most nearly perfect of any cattle, being attached high behind and well forward and having a flat sole, with the teats of medium size and well placed. Ayrshires are prepotent, commonly breeding true to form. There is no lover of perfection in animal form who is not strongly attracted by the lines, the vigor and character, and the perfection of udder of the Ayrshire.

The Ayrshire is notably long-lived. She matures a little slowly, being frequently at her best at ten or eleven years, and continues useful to a great age. She is hardy, vigorous, and

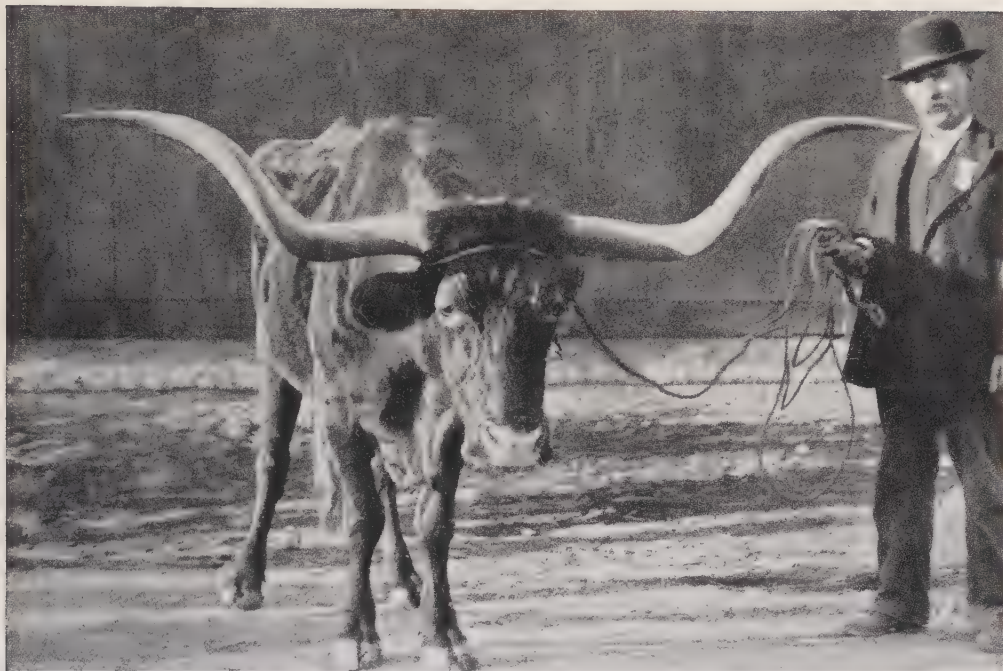
disease-resistant. She is an excellent grazer and makes economical use of the feeds she consumes. Her calves are healthy and strong at birth and easily raised. Her milk is of the highest quality, testing 4 per cent in fat, the globules very small, and it is so well balanced in its nutrients that the breed is not only a favorite with market-milk venders, but popular in certified dairies and others where quality is emphasized. Ayrshire milk is in special favor with physicians and dietitians.

ABERDEEN-ANGUS

(For illustration, see Color Plate XIX)

Notable among the breeds of cattle for beef production is the Aberdeen-Angus. Its native home is in eastern Scotland, north of latitude 56°, where the three counties of Aberdeen, Kincardine, and Forfar line up in bold face against the North Sea. This land of hill and dale has a rugged climate, with a touch of Scotch mist from the sea. It is a fine country for growing small cereals, potatoes, turnips, and beets, while extensive pastures furnish rich grazing for farm animals.

Here for many generations have lived and prospered a thrifty farmer folk who specialize in breeding cattle. In southern Aberdeen, in the Buchan district, the breed was known as "Buchan humlies." In the Angus section of



Photograph by Texas Farm and Ranch Company

OLD GERONIMO (SEE TEXT, PAGE 710)

This old warrior of the Southwest is reminiscent of "Buffalo Bill" and his Wild West Shows and was one of the last of the real "Texas Longhorns." His very name calls up visions of a famous old Indian chieftain. At the time this picture was made, in 1899, the steer was supposed to have been 36 years old.

Forfar they were "Angus doddies." Various words were used by the Scotch, such as "hum-lies," "doddies," "dodded," etc., to indicate that they were polled or hornless.

In America the word "polled" is universally used as applied to cattle that are naturally hornless. While Aberdeen-Angus is the correct name of this breed, whether in Scotland or in America, in its adopted home, the name "Polled Angus" is in common usage.

The origin of this breed has been the subject of much speculation. Some have expressed the opinion that these polled cattle originated as sports from black cattle with horns. Others have thought them descended from hornless prehistoric stock, and that they may be of Scandinavian ancestry introduced into Britain by the Norsemen, for hornless cattle have a long record in Norway and Sweden. Professor James Wilson assumes that they are not descended from sports, but come from the same race of hornless stock and are presumably of Scandinavian origin.

Historically, polled cattle have been a matter of record in Scotland only since 1752, when a Mr. Graham entered in an account book the purchase of "one humble oax." The first printed reference to hornless cattle in Angus is dated 1797 in the old Statistical Account of the parish of Bendochy, which states that "there are 1,229 cattle in the parish, many of them

dodded, wanting horns." Documentary evidence of polled cattle in Aberdeen is said to date back to 1523.

The first noteworthy improvement of the black polled cattle of this section of Scotland began with Hugh Watson, of Keillor, Forfarshire, who was born in 1789 and died in 1865. He was a great constructive breeder and produced an earlier-maturing, heavier-fleshed, thicker type that dressed out at slaughter to produce more and better meat than had heretofore been known.

Among the remarkable cows owned by Watson was Old Grannie. In the 36 years of her life she had 25 calves—one of the most wonderful records for longevity and fecundity in the bovine world.

One of the greatest cattle breeders of all time, William McCombie, of Tillyfour, Aberdeenshire, began with the "doddies" shortly after Watson took them up, and did more to make their merits known than any other early improver of the type. He developed the famous Pride of Aberdeen and other celebrated families; carried the Aberdeen-Angus colors to world's championships at the Paris Universal Exposition, and was the producer of the far-famed bullock Black Prince, that brought his breeder signal honors from the late Queen Victoria.

Some of the more characteristic features of



Wide World Photograph

CAUGHT OFF HIS GUARD IN THE PLAZA DE TOROS, MADRID

This Spanish bullfighter had been advancing from the side when the animal made a sudden turn, catching him with one horn. By good fortune the toreador made his escape with only minor injuries.

the Aberdeen-Angus are the black color, hornless and comparatively short head, compact, low-set body, fine quality of flesh, and high percentage of marketable carcass to offal in killing. While black is the almost universal color, occasionally red sports occur, an inheritance from early days, when these cattle were red as well as black. Red animals of the breed, however, are not permissible of record in the Herd Books of to-day.

The head of the Aberdeen-Angus is short, broad of muzzle, prominent of eye, with the poll, or top skull, neatly pointed, and is representative of what stockmen designate as a "feeder's head." Good examples of the breed are highly developed in back and quarters, where the high-priced cuts of meat are found, while the neck and leg, which furnish the cheaper cuts, are comparatively short.

At maturity these are heavy-weighing cattle in proportion to their size, although they weigh slightly less than the Shorthorn and Hereford, notwithstanding the fact that some animals of the breed have attained notably heavy weights.

Scarcely more than a half century ago Aberdeen-Angus cattle were first imported to America by George Grant, of Victoria, Kansas, yet in this time they have attained more high honors in competition on the butcher's block than any other breed. Their great record in America begins with the first show of the International Live Stock Exposition in 1900.

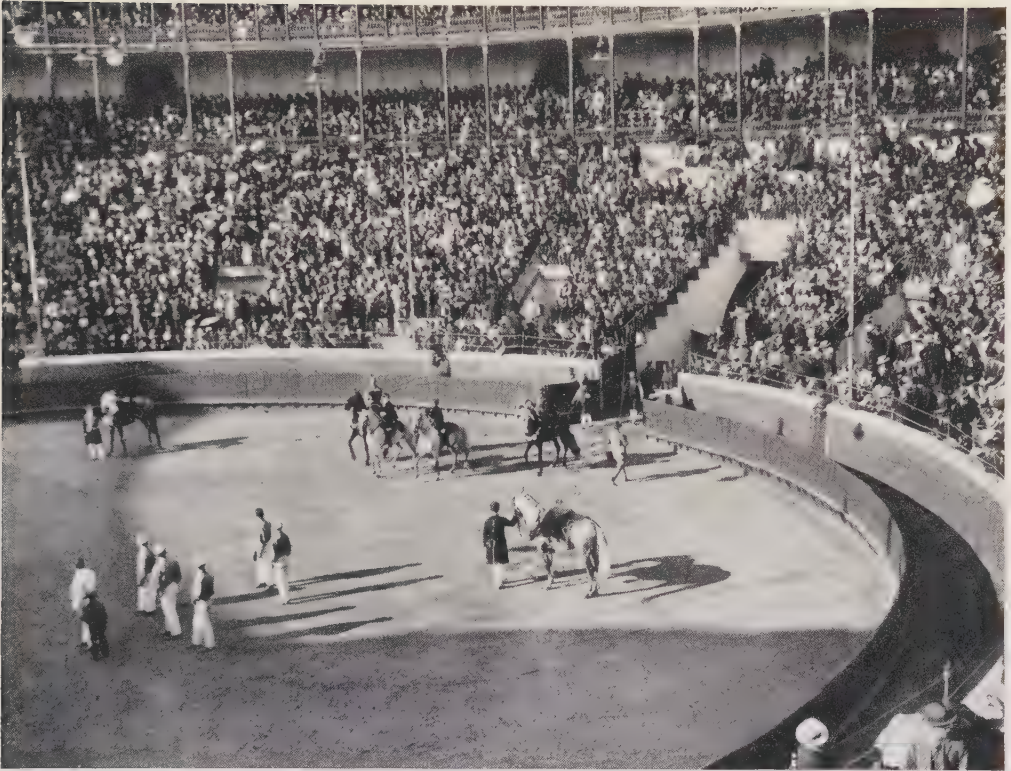
Since then 22 grand championships on single steers have been awarded at the International, of which 13 have been won by Aberdeen-Angus purebreds or grades. In the annual competition of carloads of fat cattle at the International since 1900, out of 23 grand championship awards the Aberdeen-Angus has won 19—a remarkable record.

In the British competitions similar results have obtained. Carlots were slaughtered, and found special favor among the butchers because of the small percentage of offal to merchantable carcass and the superior quality of the flesh, without heavy external layers of fat. Buyers pay the highest prices for these cattle, as well-fattened steers of the breed may be expected to dress out 65 per cent or better of carcass to offal.

Prime Aberdeen-Angus bullocks are generally recognized as the best of all "killers," so far as the production of rich, thick-cutting, finely-marbled flesh is concerned. The fat is evenly distributed throughout the entire carcass.

The crossing of the Aberdeen-Angus with horned cattle, as a rule, results in polled progeny that kill to furnish carcass superior to the horned parent. This hornless cross is also highly valued, as polled cattle suffer no injury from horns and feed together more quietly and in closer quarters than do cattle with horns.

The Aberdeen-Angus Cattle Society in Scotland and the American Aberdeen-Angus Breed-



Photograph by Franklin L. Fisher

THE ENTRANCE OF THE BULLFIGHTERS: LISBON

In Portugal bullfighting is a sport of skill shorn of much of the brutality which marks the contests in Spain. The horses are not gored and the bull is not killed, but after the toreador has successfully implanted a certain number of *banderillas* in the animal's back it is pronounced "dead" by the judges and is then driven from the arena.

ers' Association promote the breed in Britain and on this side, engage in registration of pure-bred animals, and publish Herd Books. In the American register 388,594 animals have been recorded. Quite a number of boys' and girls' calf clubs in the Middle West are promoting this black polled breed (see illustration, page 687).

The Aberdeen-Angus does not have so wide a world distribution as the Shorthorn or Hereford, but it is steadily growing in popularity in the land of its nativity, in England, Canada, and the United States.

THE GALLOWAYS

A first cousin of the Aberdeen-Angus is the Galloway, native to the district of that name in extreme southwestern Scotland, which to-day includes the old shires of Wigtown and Kirkcudbright.

The present-day area of Galloway, some 40 by 90 miles, with a sea front on the south and west, has a variable surface of wide moors, rough hills, and heather-topped mountains. The climate is damp and cloudy much of the time, cold and inclement in winter and often cool in

summer. Much of the land is well suited to grass, and cattle graze upon the pastures through most of the year.

The origin of the Galloway is involved in the same obscurity which attaches to the Aberdeen-Angus. Developed in a region where horns were not uncommon, breeders by selection have gradually established the polled type. About 1789 George Culley wrote of "polled or humbled" cattle, and stated that "for the original of these we must look in Galloway."

English cattle buyers early showed a preference for polled varieties, and "by the end of the eighteenth century as many as 20,000 head of cattle were driven from Galloway to the English markets."

In hornless character, color, and general form the Galloway and Aberdeen-Angus bear a close resemblance. As a rule, however, the Galloway is not so wide of back and deep of body; neither does it fatten so easily as the Aberdeen-Angus, although it produces a superior carcass. These cattle are extremely hardy, and have made a fine record in this regard at the Alaska Experiment Station at Sitka, where they have been bred for a number of years.



Photograph by Kiyoshi Sakamoto

A JAPANESE "OX COBBLER"

In the Island Empire of the Far East the oxen wear straw sandals to protect their hoofs.

A striking feature of the breed is the wonderful coat of long, black or brown-black, silky hair that is in its most attractive condition during the early winter season. It consists of two parts, a soft, silky, close undercovering and a long, soft, moderately curly outer coat. This heavy coat of hair affords the animal protection from storms in winter, suiting them especially for exposure on the open range (see page 692).

Well-tanned Galloway hides, with the thick, long fall or winter coat of hair, make unsurpassed robes, floor rugs, or overcoats and sell for high prices.

The carcass of the Galloway meets a high-quality market demand because of its fine grain and moderate covering of white fat. Although introduced here many years ago, these cattle have not played much of a part in the American market because of the small number of herds.

For many years, in northern England and southwest Scotland, cattlemen have been producing what are known as "blue-gray" cattle for the butcher, the result of crossing Galloways and white Shorthorns. Such a cross produces an unsurpassed and extremely popular carcass.

An interesting variation from a typical example of this breed is found in a very limited way in Scotland, and is known as the Belted Galloway. These cattle have the same general characteristics as the ordinary Galloway, except for a band of white encircling the body between hips and shoulders. They are also regarded as superior milkers.

A leading Scotch breeder writes that belted cattle have been bred in Galloway from time

immemorial, but until recently only two breeders in Scotland and two in England have attempted to breed them with the view of perpetuating this belted character.

Organized effort in promoting Galloway cattle first took place in 1862 in Scotland, when the Polled Herd Book was started, in which were included both Galloway and Aberdeen-Angus in the first four volumes. In 1877 an independent Galloway Cattle Society was formed, which has been in existence ever since and which has published many volumes of Herd Books. An American Galloway Cattle Breeders' Association was organized in 1882 and supervises the breed welfare in this country. In its Herd Book are registered 49,440 animals.

THE TEXAS LONGHORN

(For illustration, see Color Plate XX)

This picturesque type, once so familiar on our Southwestern ranges, is of Spanish origin and is now extinct, so far as our present range-cattle business is concerned. When the first Europeans landed on the North American Continent they found no domestic animals except the dog. The natives knew nothing of the cow, horse, ass, sheep, goat, or swine.

The introduction of cattle on this continent was made at two points about the same time, but more than 2,000 miles apart, and separated by a vast unexplored country—one by the Spaniards in the West Indies, the other by Portuguese on Cape Breton Island.

